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DYNAMIC GAS TEMPERATURE
MEASUREMENT SYSTEM
FINAL REPORT

VOLUME 2
OPERATION AND PROGRAM MANUAL

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SECTION 1 INTRODUCTION

The Hot Section Technology (HOST) Dynamic Gas Temperature Measurement System Computer Program acquires data from two Type B thermocouples of different diameters. The analysis method then determines the insitu value of an aerodynamic parameter Γ , containing the heat transfer coefficient from the transfer function of the two thermocouples. This aerodynamic parameter is then used to compute a frequency response spectrum and compensate the dynamic portion of the signal of the smaller thermocouple. Detailed discussions of the calculations for the aerodynamic parameter and the data compensation technique are presented in Section III.C. of Volume I. Compensated data is presented in either the time or frequency domain. Time domain data are presented as dynamic temperature vs time (compensated or uncompensated). Frequency domain data are presented per the table below (compensated or uncompensated):

<i>Function</i>	<i>Dimensions</i>	<i>Engineering Units</i>
• Power Spectral Density (PSD)	Mean Square/Hz	$^{\circ}\text{F}^2/\text{Hz}$ (K^2/Hz)
• Log Power Spectral Density = $10 \log_{10}$ PSD	Mean Square/Hz	db ref $1^{\circ}\text{F}^2/\text{Hz}$ ($0.309\text{K}^2/\text{Hz}$)
• Linear Power Spectral Density = Positive Square Root of PSD	$\text{rms}/\sqrt{\text{Hz}}$	$^{\circ}\text{F}/\sqrt{\text{Hz}}$ ($0.556\text{K}/\sqrt{\text{Hz}}$)
• Narrowband Frequency Spectrum = Positive square root of autospectral density (autopower) function with narrowband signal correction for FFT windowing function applied and no normalization to per unit bandwidth	rms	$^{\circ}\text{F}$ (K)

The data analysis and compensation software was implemented on a digital computer based Hewlett Packard (HP) model 5451C Fourier Analyzer system. This manual contains the computer program listings, software operating instructions and computer hardware requirements. Extensive use was made of the HP system operating software package. For convenience, English units were used exclusively throughout the software.

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SECTION II
SYSTEM DESIGN

The HOST System is built around a HEWLETT-PACKARD 5451C FOURIER ANALYZER with 64K words of memory. The hardware required to run the system is listed in the table below:

DESCRIPTION	PART NO.
21MX E-Series Computer	54451A
System Control	5477A
Display Unit	5460A
Analog to Digital Converter	5466R (1)
Control Unit	5475A
Low Pass Filter (4 each)	54440A
I/O Extender	12979B
Digital Tape Unit	7970E
Disc Drive	7900A (2)
Disc Power Supply	13215A
Graphics Terminal	2648A
Video Hard Copy Unit	4632 (3)
Signature Analysis Control Panel	-

- (1) 4 Channel Option is required.
- (2) This disc drive has been updated to 7906.
- (3) Hard copy unit is manufactured by Tektronix.

The software for this system is based on the HEWLETT-PACKARD software supplied with the 5451C FOURIER SYSTEM. All functions in the standard Fourier System are maintained, boot-up and operation instructions are per the system manual. However additional software has been added to drive the HOST System.

This manual is divided into two sections:

- a. SYSTEM OPERATION - This section explains how to operate the HOST System Software.
- b. SYSTEM SOFTWARE - This section provides a complete listing of HOST System Software, and the Command Files used to generate the HOST System Overlay.

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SECTION 1 - SYSTEM OPERATION

System operation is divided into 3 parts, these are:

- o Theoretical TRANSFER FUNCTION of the large wire thermocouple to the small wire thermocouple.
- o Measured TRANSFER FUNCTION of the large wire thermocouple to the small wire thermocouple.
- o Data processing and plotting.

The abbreviation " $H(f)$ " will be used in place of the words 'TRANSFER FUNCTION' whenever that process is implied.

System input is accomplished by setting SYSTEM EDITS. During each part of system operation, a series of questions pertaining to that part of system operation is asked by the system to the user. Operation is then done per these edits.

1.0 THEORETICAL $H(f)$ OF THE LARGE WIRE THERMOCOUPLE TO THE SMALL WIRE THERMOCOUPLE.

This part consists of 4 phases, these are:

- o Inputting thermocouple wire and gas stream parameters.
- o Storing this data on the system disc.
- o Generating a family of curves, from .5 to 1.5 GAMMA, of the thermocouple wire vs. the gas stream, both large wire and small wire.
- o Dividing the two families (large wire/small wire) to obtain a third family of curves.

1.1 Thermocouple wire and gas stream parameter input is accomplished by setting SYSTEM EDITS. To access the edits for this part of the system, press RESTART, EDIT, AUTO-SEQ and YES on the SYSTEM CONTROL panel. A copy of these edits appears on the next page. Although the edits are self explanatory, edit no. 25 needs further clarification. This edit sets the frequency code for the family of curves about to be generated. It also sets the following system constraints:

- o Only 4 delta-f settings are allowed. These are .2, .5, 1, and 2.
- o Only -1, and 0 may be entered for powers of 10. That is, when the delta-f setting is .2 or .5, then a -1 must be entered for the power of 10. When the delta-f setting is 1 or 2, then a 0 must be entered.
- o Edit no. 28 must be an integer multiple that is greater than or equal edit no. 25

FAILURE TO OBSERVE THESE CONSTRAINTS WILL RESULT IN
ERRONEOUS DATA!!!

1.2 The second phase consists of storing these edits on the system disc. Program edits are stored in a SET-UP and up to 100 set-ups can be stored on the system disc. After setting the edits for a particular T/C, the set-up is stored by pressing RESTART, MODE SHIFT and SAVE on the SYSTEM CONTROL panel. The system will ask what number to save the set-up into and the operator enters a number between 1 and 100. The program edits are now saved on the disc. Two set-ups are required for this part of system operation, one for the small wire T/C and another for the large wire T/C. One last note about set-ups, set-ups 1 thru 10 can be used for storage and processing. Set-ups 11 through 100 can only be used for storage.

DYNAMIC TEMPERATURE MEASUREMENT 24 FUEL TO AIR RATIO (F/A)?
THEORETICAL H(f) CRITERIA < rtio > < pwr 10 >
2 -2

PRINT PARAMETER VALUES?

'YES' FOR ALL; LINE # FOR SINGLE PRINT THE REST OF THE PARAMETERS?

11 T/C CODE (0=Pt/6%Rh, 1=Pt/30%Rh)?
CODE: 0

12 LENGTH OF SUPPORT WIRE (INCHES)?
< length > < pwr 10 >
75 -3

13 LENGTH OF SMALLER WIRE (INCHES/2)?
< length > < pwr 10 >
28 -3

14 DIAMETER OF SUPPORT WIRE (INCHES)?
< dmt > < pwr 10 >
15 -3

15 DIAMETER OF SMALLER WIRE (INCHES)?
< dmt > < pwr 10 >
295 -5

21 MEAN GAS TEMPERATURE (DEG-F)?
< temp > < pwr 10 >
1700 0

22 MEAN GAS PRESSURE (PSIA)?
< pres > < pwr 10 >
290 0

23 MACH NUMBER?
< numb > < pwr 10 >
2251 -4

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25 THEORETICAL DELTA-F SETTING?

-- < stts > < pwr 10 >
2 0

26 STARTING FREQUENCY?

< freq > < pwr 10 >
10 0

27 ENDING FREQUENCY?

< freq > < pwr 10 >
60 0

28 FREQUENCY INCREMENT?

< incr > < pwr 10 >
2 0

29 LARGE OR SMALL WIRE T/C?
(0=SMALL, 1=LARGE) 0

30 EVALUATE (LARGE WIRE/SMALL WIRE)
T/C H(?)? (0=NO, 1=YES) 0

ENTER LINE # TO EDIT, NO TO STOP

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- 1.3 The third phase consists of recalling a set-up for the large or small wire T/C and generate the transfer function of that T/C to the gas stream. This is accomplished by using the FINITE ELEMENT MODEL algorithm developed at P&WA. To recall a set-up, press RESTART, MODE SHIFT and RECALL on the SYSTEM CONTROL panel, and then enter the desired set-up number. The contents of the set-up on the disc remain unaltered. Press AUTO-SEQ to start generating the transfer function. Upon completion, the system will print ALL DONE! on the terminal.
- 1.4 The final phase consists of recalling the remaining set-up and generating its transfer function. At this point, edit no. 30 should have been set to 1 so that the transfer function of the large wire to small wire T/C can be evaluated.

2.0 MEASURED $H(f)$ OF THE LARGE WIRE T/C TO THE SMALL WIRE T/C.

- 2.1 The first phase of this part consists of recalling the set-up for the small wire T/C. This must be done because if the set-up for the large wire T/C is in core, the system may generate a compensation spectrum for that T/C, RESULTING IN ERRONEOUS DATA!!
- 2.2 The second phase consists of setting the program edits for this part of the program. To access these edits, press RESTART, EDIT, MAP TIME and YES. The edits will be listed on the terminal. A copy of these edits appears on the next page. Although the edits are self explanatory, there are a few points worth mentioning:
 - o The number entered for edit no. 8 must never be less than 70 because record no. 70 is the first record where raw time domain data is stored.
 - o Amplifier gains are entered in VOLTS/VOLT.
 - o Record levels and DC offsets are entered in VOLTS.
- 2.3 The last phase of this part consists of acquiring the data. Press MAP TIME on the SYSTEM CONTROL panel to enter this phase. The system will acquire data, scale it degrees farenheit, remove any DC offset if an offset was entered, and store it on the disc. A maximum of 122 records of data can be acquired. The system will evaluate a transfer function between the large and small wire T/C and determines if the measured $H(f)$ curve crosses any of the theoretical $H(f)$ curves. At this point one of two things happen; if the measured curve crosses any of the theoretical curves, the system will calculate an average value of GAMMA and display the result. Press CONTINUE on the CONTROL UNIT to generate the compensation spectrum based on the measured value of GAMMA. This process takes about 40 minutes and the system will print ALL DONE! upon completion. If the measured curve did not cross any of the theoreticals then a message to that effect is displayed on the terminal and processing stops.

DYNAMIC TEMPERATURE MEASUREMENT -
MEASURED IN ?) CRITERIA

PRINT THE REST OF THE PARAMETERS?

PRINT PARAMETER VALUES?

'YES' FOR ALL, LINE & FOR SINGLE

05 ADC DELTA-F SETTING?

< stls > < pwr 10>

2 0

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06 ACQUIRE NEW DATA OR RE-PROCESS
FROM THRU-PUT FILE? (0= NEW DATA,
1=RE-PROCESS) 1

* IF ACQUIRING NEW DATA:

*

* 07 NUMBER OF THRU-PUT RECORDS
* DESIRED? 64

* IF DATA IS RE-PROCESSED:

*

* 08 STARTING RECORD NUMBER? (70,
* 73, 76, ETC.) 70

*

* 09 NUMBER OF POWER SPECTRUM AVG'S
* DESIRED? 120

13 NEW GAMMA AND NEW COMP. SPEC.?
(0=NO, 1=YES) 1

14 OLD GAMMA BUT NEW COMP. SPEC.?
(0=NO, 1=YES) 0

15 GAMMA VALUE:
< valu > < pwr 10>
6284 -8

10 CHANNEL 'A' AMPLIFIER GAIN?

< gain > <Pwr 10>
50 0

ENTER LINE # TO EDIT, NO TO STOP

11 CHANNEL 'A' RECORD LEVEL?

< lev1 > <Pwr 10>
1 0

12 CHANNEL 'A' DC OFFSET?

<offset> <Pwr 10>
0 0

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20 CHANNEL 'B' AMPLIFIER GAIN?

< gain > <Pwr 10>
50 0

21 CHANNEL 'B' RECORD LEVEL?

< lev1 > <Pwr 10>
1 0

22 CHANNEL 'B' DC OFFSET

<offset> <Pwr 10>
0 0

30 CHANNEL 'C' AMPLIFIER GAIN?

< gain > <Pwr 10>
50 0

31 CHANNEL 'C' RECORD LEVEL?

< lev1 > <Pwr 10>
1 0

32 CHANNEL 'C' DC OFFSET?

<offset> <Pwr 10>
0 0

3.0 DATA PROCESSING AND PLOTTING

3.1 Just as before the first phase is to set the edits for this part of system operation. Press RESTART, MODE SHIFT, EDIT, MAP TIME and YES on the SYSTEM CONTROL panel and the edits will be listed. Again a copy of these edits appears on the next page. Unlike the previous parts, this one is very deceiving. Great flexibility has been built into this part of the system. The following plot presentations are available:

o INSTANTANEOUS DATA

- . Small wire compensated or uncompensated, time or freq
- . Large wire compensated or uncompensated, time or freq

o AVERAGED DATA

- . Small wire compensated or uncompensated, freq only
- . Large wire uncompensated, freq only

3.2 After setting the system edits, press RESTART, MODE SHIFT, and MAP TIME and FREQUENCY ranges are available.

3.2 After setting the system edits, press RESTART, MODE SHIFT, and MAP TIME to plot the data.

This concludes the OPERATION SECTION of this manual.

```

DYNAMIC TEMPERATURE MEASUREMENT - *
PROCESSING AND PLOTTING CRITERIA *
*
PRINT PARAMETER VALUES? *
"YES" FOR ALL, LINE # FOR SINGLE *
*
10 PLOT UNCOMPENSATED OR COMPENSATED *
DATA? (0=UNCOMP, 1=COMP) 0 *
*
20 PLOT AVERAGED OR INSTANTANEOUS PRINT THE REST OF THE PARAMETERS?
DATA? (0=AVG, 1=INST) 1
*****
* IF DATA IS INSTANTANEOUS:
*
* 21 STARTING RECORD NO.? 70
*
* 22 NO. OF RECORDS? 3
*
* 23 THRESHOLD TO CLEAR ON FREQ DA-
TA IN "dB"? -60
*
* 24 NO. OF "SMOOTHs" TO PERFORM ON
TIME DATA? 0
*
* 25 PLOT TIME & FREQ DATA? (0=TIME
ONLY, 1=TIME & FREQ) 1
*****
* IF DATA IS AVERAGED:
*
* 26 PLOT LARGE OR SMALL WIRE DATA?
(0=SMALL, 1=LARGE) 0
*
30 PLOT FULL OR PARTIAL TIME RANGE?
(0=FULL, 1=PARTIAL) 1
*****
* IF A PARTIAL RANGE IS DESIRED:

```

```

31 STARTING TIME?
< time > < pwr 10 >
450 +3
32 ENDING TIME?
< time > < pwr 10 >
475 -3

```

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35 PLOT FULL OR PARTIAL FREQ RANGE?

(0=FULL, 1=PARTIAL)

* IF A PARTIAL RANGE IS DESIRED:

+

* 36 STARTING FREQ?

* < freq > < pwr 10 >

* 0 0

*

* 37 ENDING FREQ?

* < freq > < pwr 10 >

* 1000 0

40 ENTER PLOT CODE PER BELOW. (FREQ
DATA ONLY)

1=(RMS DEG-F)

2=(RMS DEG-F)/SQRT-HZ

3=(MEAN-SQR DEG-F)/HZ

4=(MEAN-SQR DEG-F)/HZ - dB

51 TOP LINE HEADER?

C/O OF 9 NODE RC CKT'S

52 BOTTOM LINE HEADER?

1-8-83 WWR

ENTER LINE # TO EDIT, NO TO STOP

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SECTION 2 - This section is divided into five parts listed below:

o SYSTEM ROUTINES

- 1) Keyboard Routines
- 2) Fortran Routines
- 3) Fortran Subroutines
- 4) System Subroutines
- 5) Keyboard Subroutines
- 6) Text Buffers

o SYSTEM ARRAYS

- 1) Keyboard Program End Codes
- 2) Data Block Qualifiers
- 3) Thermocouple Wire and Gas Stream Parameter Equation Coefficients
- 4) N.B.S. Temperature Equation Coefficients
- 5) Input Array
- 6) Thermocouple Wire Parameters
- 7) Gas Stream Parameters
- 8) Finite Element Coefficients - A,B,C,E,F&G
- 9) Finite Element Coefficients - Z1 thru Z9
- 10) Finite Element Solution - ZP(1) thru ZP(9)
- 11) Scratch

o DATA ASSIGNMENTS

- 1) Variable Parameter Assignments
- 2) File 1 Record Assignments

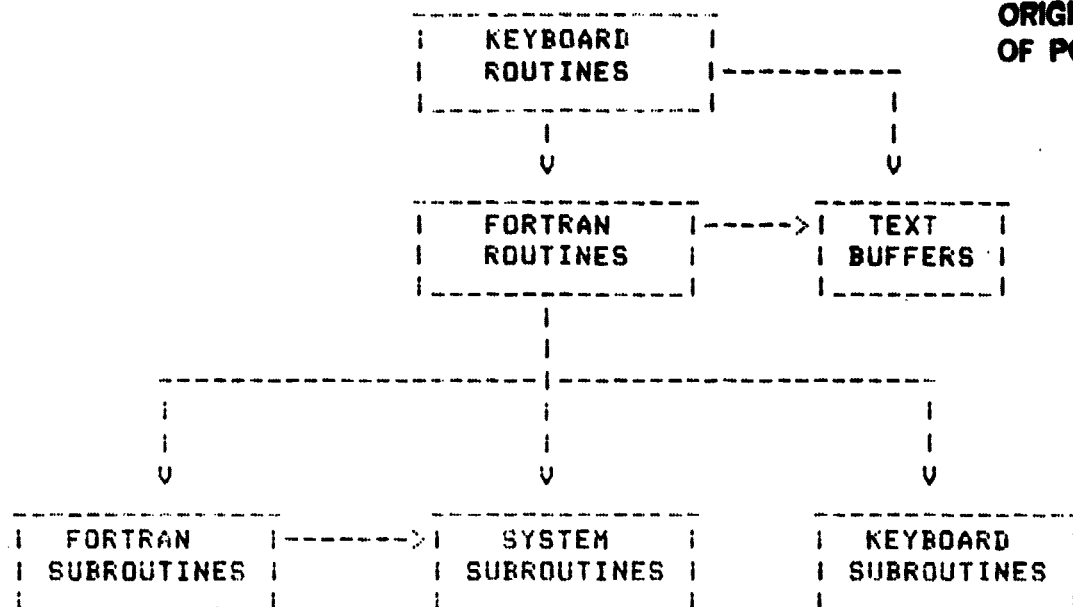
o SYSTEM ALGORITHMS

- 1) Thermocouple Wire Parameters
- 2) Gas Stream Parameters
- 3) Finite Element Solution Coefficients
- 4) Finite Element Solution

o SYSTEM COMMAND FILES

1.0 SYSTEM ROUTINES - A diagram showing how these routines are broken down and linked together appears below.

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1.1 Keyboard Routines

NO.	DEFINITION
11	Edit Routine - all edits
12	Finite Element solution $H(f)$ Routine
13	Data Scaling Routine
17	Instantaneous Compensated Data Routine
18	Clear Routine
20	Edit Routine - all edits
21	Smoothing routines
22	Set-up Save Routine
23	Set-up Recall Routine
36	Graphics routines
39	Graphics routines
49	Clear Routine
50	Power Spectrum and Measured $H(f)$ Routine
51	Data Acquisition and Transcription Routine
59	Plot routines
100	Edit Routine - Theoretical $H(f)$
101	Edit Routine - Theoretical $H(f)$
102	Edit Routine - Measured $H(f)$
103	Edit Routine - Measured $H(f)$
104	Edit Routine - Measured $H(f)$
105	Edit Routine - Measured $H(f)$
106	Edit Routine - Processing & Plotting
107	Edit Routine - Processing & Plotting
108	Edit Routine - Processing & Plotting
109	Edit Routine - Processing & Plotting

1 L	-11		
5 L	1000		
9 Y	1800	180	-2
15 L	1010		
19 Y	5843	180D	
24 Y	1802	180	
29 #	1010	12	0
35 <			
38 L	2000		
42 Y	1800	180	2
48 L	2010		
52 Y	5843	180D	
57 Y	1801	180	
62 #	2010	12	0
68 <			
71 .			

KYBD STACK 11

o Enables/disables pushbutton switches on 5477A SYSTEM CONTROL UNIT by setting VP No. 180

- 1) VP 180 = -2, (LABEL 1000),
DISABLE
- 2) VP 180 = 2, (LABEL 2000),
ENABLE

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KYBD STACK 12

Finite element solution
(F.E.S.) routine.

1) LABEL 1000 - F.E.S. for
theoretical value of σ_{max}

2) LABEL 2000 - F.E.S for
measured value of σ_{max}

1 L	-12							
5 L	1000							
9 Y	3020	1						
14 MS	38							
18 MS	18							
22 Y	5844	4						
27 Y	1805	20	1	1				
34 J	100	100		-				
39 Y	5838	10						
44 Y	5819	3	1					
50 Y	5819	1	1					
56 Y	5819	6	1					
62 MS	38	16						
67 MS	18							
71 Y	6020	199	2	201	56	0	-1	
81 Y	6021							
85 Y	6022							
89 Y	6023							
93 MS	37							
97 MS	27							
101 MS	37	390						
106 MS	27							
110 Y	6024	11	0	1				
117 Y	5838	10						

122 Y	5819	8	1					
128 Y	1805	198	1	4				
135 MS	38	19						
140 MS	18							
144 Y	6020	199	2	201	56	0	-1	
154 Y	6026	11	10	30	50			
162 MS	38							
166 MS	18							
170 Y	5844	-4						
175 D								
178 L	2000							
182 MS	38	16						
187 MS	18							
191 Y	6020	199	2	201	56	0	-1	
201 MS	31	7						
206 MS	11							
210 TP								
213 MS	11	1						
216 Y	6021							
222 Y	6022							
226 Y	6023							
230 Y	6027	262D	50	11	2	0	1	
240 D								
243 Y	5836	10						

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248 Y	5819	3	1
254 Y	5819	1	1
260 Y	5819	6	1
266 MS	37		
270 MS	27		
274 MS	37	39D	
279 MS	27		
283 Y	6024	1	1
290 MS	38	18	
295 MS	18		
299 Y	1823	1	1
306 Y	6050	1	2048
315 MS	31	9	
320 MS	21		
324 Y	3020		
328 D			
331 .			

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KYBD STACK 13

1 L	-13			
5 L	100			
9 *	4			
13 F				
16 *-				
8	0	2		
24 L	200			
28 Y	1800	2	223D	
34 Y	1803	3	224D	-1
41 Y	1827	3	10	3D
48 Y	1805	281	5	6
55 L	999			
59 Y	5814			
63 Y	5838	50		
68 Y	5819	6	1	
74 D				
77 J	999	-1		
82 Y	1805	281	4	3
89 J	210			
93 TL				
96 J	300	-1		
101 Y	1805	281	3	2
108 J	210			
112 J	300	-1		

- o Scales Frequency Data based on the value of UP No. 281 (Plot Code)
- o Will print an error message if an illegal code is entered.

117 Y	1805	281	2	3
124 J	210			
128 Y	3201			
132 J	300	-1		
137 Y	1805	281	1	2
144 Y	3201			
148 J	300	-1		
153 J	999	-1		
158 L	210			

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162 :	0	3376	
167 *	0	1000	
172 :	0	2D	
177 *	0	3D	

-----> Wideband correction factor for P301
Window ($3.376 \times \Delta f$)

182 <

185 L 300

189 D

192 J 200 36

197 <

200 .

1 L -17

5 L 100

9 Y 3020

13 Y 1800 0 266D

19 Y 1802 1 267D

25 Y 6007 0

30 X> 4

34 :

37 H1

40 X> 5

44 MS 31 9

49 MS 11 6

54 TR 6

58 CL 0

62 CL 1

66 CL 2

70 CL 3

74 L 200

78 MS 31 0D

83 MS 11 2

86 Y 1801 0 0D 3

95 MS 31 0D

100 MS 11 3

105 X< 2

KYBD STACK 17

o Routine to compensate instantaneous time domain data.

o Routine compensates data for distortion caused by:

1) Dividing by the compensation spectrum

2) Performing and inverse Fourier X-Form

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109 J	210				
113 Y	1805	1	1	11	1
121 CL	0	0	256		
127 CL	0	1796	2047		
133 Y	1805	269	1	3	
140 L	205				
144 J	100	21			
149 #	205	269D	0		
155 B					
158 J	100	36			
163 Y	1805	270	1	1	
170 J	100	13			
175 J	300	-1			
180 -	0	512			
185 CL	0	1024	2047		
191 X>	1				
195 X<	2				
199 -	0	1024			
204 CL	0	1024	2047		
210 CL	3	1024	2047		
216 -	3	1024			
221 A+	3				
225 J	210				
229 -	0	1536			

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234 Cl.	0	0	1023	
240 A+	1			
244 Y	1805	269	1	3
251 L	220			
255 J	100	21		
260 &	220	269D	0	
266 D				
269 J	100	36		
274 Y	1803	270	1	1
281 J	100	13		
286 &	200	1D	0	
292 J	300	-1		
297 L	210			
301 *	5			
305 F				
308 J	100	18		
313 :	6			
317 F				
320 :	5			
324 <				
327 L	300			
331 Y	5614			
335 Y	5838	10		
340 Y	5819	8	1	
346 D				
349 J	300	-1		
354 .				

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1 L	-18			
5 L	100			
9 X	7			
13 TP	7			
17 Y	1800	4	0	
23 Y	1800	3000	0	
29 L	200			
33 Y	1821	3001	7	4D
40 Y	1805	2902	2900D	2
47 Y	1800	2900	2902D	
53 Y	1800	2901	2903D	
59 Y	1801	4	4D	5
66 #	200	205	0	
72 Y	1800	4	0	
76 Y	1804	2000	268D	20
85 Y	1827	2000	10	2000D
92 Y	1803	2000	2000D	2900D
99 L	300			
103 Y	1821	3001	7	4D
110 Y	1805	2000	2902D	1
117 CL	0	4D	4D	
123 Y	1801	4	4D	
129 #	300	1024	0	
135				
138				

KYBD STACK 18

o Routine to clear all
channels below user
input threshold.

ORIGINAL PAGE 18
OF POOR QUALITY

1 L	-20				
5 L	1500				
9 L	2500				
13 J	1000	11			
18 MS	38	3			
23 MS	16				
27 Y	3020				
31 Y	5838	8			
36 Y	5819	90	1		
42 L	1505				
46 Y	1800	180	1809		
52 Y	1808	53			
57 Y	1805	53	1	1	
64 J	1504	-1			
69 J	1520	-1			
74 L	1504				
78 Y	5838	54D			
83 Y	1805	53	2	4	
90 J	53D	55D			
95 Y	5838	6			
100 Y	5819	93	1		
106 J	1505	-1			
111 J	0	55D			
116 L	1520				

KYBD STACK 20 -----

- o Edit routine.
- o Controls listing and input to system edits.

ORIGINAL PAGE IS
OF POOR QUALITY

ORIGINAL PAGE 18
OF POOR QUALITY

120 Y	1800	19	0	
126 Y	5838	8		
131 Y	5819	92	1	
137 L	1525			
141 Y	1808	53		
146 Y	1805	53	0	1
153 J	1526	-1		
158 J	3000	-1		
163 L	1526			
167 Y	1805	53	1	1
174 J	1530	-1		
179 MS	37			
183 MS	27			
187 <				
190 L	1800			
194 Y	1800	19	1	
200 Y	1800	180	1808	
206 Y	5838	54D		
211 J	53D	55D		
216 MS	37			
220 MS	27			
224 Y	5838	8		
229 Y	5819	93	1	
235 J	1525	-1		
240 L	3000			
244 Y	5819	97	1	
250 J	1525	-1		
255 .				

ORIGINAL PAGE IS
OF POOR QUALITY

KYBD STACK 21

1 L	-21			
5 L	100			
9 CL	1			
13 Y	1800	5	0	
19 Y	1800	6	1	
25 Y	1800	7	2	
31 Y	1800	2000	5	-1
38 Y	1800	2001	25	-2
45 Y	1823	10	0	0
52 Y	1823	10	1	1
59 L	200			
63 Y	1821	2002	0	5D
70 Y	1821	2003	0	6D
77 Y	1821	2004	0	7D
84 Y	1803	2005	2002D	2001D
91 Y	1803	2006	2003D	2000D
98 Y	1803	2007	2004D	2001D
105 Y	1801	2008	2005D	2006D
112 Y	1801	2008	2008D	20007D
119 Y	1822	2008	1	6D
126 Y	1801	5	5D	
132 Y	1801	6	6D	
138 Y	1801	7	7D	
144 #	200	2046	0	

- o Smoothing routine
- o Two routines available:

1) Label 100:

$$f(x) = .25*f(x-1) + .5*f(x) + .25*f(x+1)$$

2) Label 300:

$$f(x) = \frac{f(x) + f(x+1)}{2}$$

where x = the channel number.

ORIGINAL PAGE IS
OF POOR QUALITY

150 X	1			
154 <				
157 L	300			
161 CL	1			
165 Y	1800	5	0	
171 Y	1800	6	1	
177 Y	1823	10	0	0
184 Y	1823	10	1	1
191 L	400			
195 Y	1821	2000	0	5D
202 Y	1821	2001	0	6D
209 Y	1801	2000	2000D	2001D
216 Y	1804	2000	2000D	2
223 Y	1822	2000	1	5D
230 Y	1801	5	5D	
236 Y	1801	6	6D	
242 #	400	2046	0	
246 X	1			
252 <				
255 .				

ORIGINAL PAGE 13
OF POOR QUALITY

KYBD STACK 22

1 L	-22				
5 L	2000				
9 MS	38	3			
14 MS	18				
18 Y	5844	20			
23 Y	5844	11			
28 Y	5842	2			
33 Y	5814				
37 Y	5838	9			
42 L	1003				
46 Y	5819	75	1		
52 Y	5819	64	1		
58 Y	1808	480			
63 Y	1805	480	1	1	1
71 J	1003	-1			
76 Y	1805	480	100	1	-1
84 J	1003	-1			
89 MS	37				
93 MS	27				
97 MS	37	480D			
102 MS	17				
106 Y	5506	1	74D	1	
113 Y	5506	1	187D	2	
120 MS	37				

o Set-up save routine.

o Set-up is stored into
COMMON area designated
by VP # 480

124 MS	17			
128 Y	5506	0	74	1
135 Y	5506	0	187	2
142 Y	1800	39	480D	
146 MS	37	480D		
153 MS	27			
157 MS	37			
161 MS	17			
165 Y	5844	-20		
170 Y	5844	-11		
175 L	9999			
179 D				
182 J	9999	-1		
187 .				

**ORIGINAL PAGE IS
OF POOR QUALITY**

1 L	-23					
5 L	2000					
9 Y	5844	20				
14 Y	5844	12				
19 Y	5814					
23 Y	5838	9				
28 L	1003					
32 Y	5819	74	1			
38 Y	5819	64	1			
44 Y	1808	480				
49 Y	1805	480	1	1	1	
57 J	1003	-1				
62 Y	1805	480	100	1	-1	
70 J	1003	-1				
75 MS	37	480D				
80 MS	17					
84 Y	1800	83	32767			
90 Y	1800	84	0			
96 Y	1800	123	0			
102 MS	37					
106 MS	27					
110 Y	5844	-20				
115 Y	5844	-12				
120 L	9999					
124 D						
127 J	9999	-1				
132 .						

 KYBD STACK 23

- o Set-up recall routine
- o Routine recalls COMMON area designated by VP # 480.

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OF POOR QUALITY

KYBD STACK 36

u Graphics routine.

1 L	-36				
5 L	100				
9 MS	38	4			
14 MS	18				
18 Y	5838	50			
23 Y	5821	6			
28 Y	5804				
32 Y	5805				
36 Y	5809				
40 Y	5814				
44 Y	1805	271	1	2	
51 Y	5810	274D	275D	272D	273D
59 J	110	-1			
64 Y	5810				
68 L	110				
72 Y	5864				
77 Y	5816	1			
82 Y	5815				
86 Y	5817	5			
91 J	100	39			
96 D					
99 <					
102 L	200				
106 MS	38	4			

ORIGINAL PAGE IS
OF POOR QUALITY

111 MB	18				
115 MS	5838	50			
120 Y	5821	6			
125 Y	5804				
129 Y	5805				
133 Y	5809				
137 Y	5814				
141 Y	1805	276	1	2	
148 Y	5810	279D	280D	277D	278D
156 J	210	-1			
161 Y	5810				
165 L	210				
169 Y	1805	281	4	3	
176 Y	5864	-1			
181 Y	5816	3			
186 J	220	-1			
191 Y	5864	1			
196 Y	5816	5			
201 L	220				
205 Y	5815				
209 Y	5817	281D			
214 J	100	39			
219 D					
222 C					
225 .					

3 L	-39			
5 L	100			
9 Y	5838	35		
14 Y	5808	975	350	
20 Y	1800	1	390	
26 Y	5819	10		
31 Y	5808	950	350	
37 Y	1801	1	390	10
44 Y	5819	10		
49 Y	1801	1	390	35
56 Y	5838	10		
61 <				
64 .				

KYBD STACK 39

o Graphics routine.

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OF POOR QUALITY

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OF POOR QUALITY

KYBD STACK 49

1 L -49

5 L 100

9 Y 1800 2000 223D 224D

16 Y 1800 2001 219D 220D

23 Y 1800 2002 245D 246D

30 Y 1804 2001 2001D 2000D

37 Y 1804 2002 2002D 2000D

44 Y 1800 1 2001D

50 Y 1800 2 2002D

56 Y 1802 1 1D

62 Y 1801 2 2D

68 <

71 .

o Routine calculates
channel limits to
clear on measured
Transfer Function.

ORIGINAL PAGE IS
OF POOR QUALITY

1 L	-50		
5 L	200		
9 Y	1800	0	0
15 L	1		
19 CL	0D		
23 Y	1801	0	0D
29 *	1	14	0
35 MS	38	4	
40 MS	16		
44 Y	6007	7	
49 MS	31	14D	
54 L	20		
58 MS	11		
62 *	7		
66 X>	1		
70 MS	11		
74 *	7		
78 X>	2		
82 MS	11		
86 F	1		
90 F	2		
94 SP	1	2	2
100 *	20	13D	0
106 MS	31	3	

KYBD STACK 50

-
- o Routine performs a tri-spectrum ensemble average and evaluates transfer function.
 - o It then clears the data block according to the channel limits calculated in stack 49.
 - o Finally it jumps to stack 12 to determine the measured value of gamma.

111 Y	1500	0	3
117 J	100	49	
122 L	30		
126 *	0D	2	
131 MS	21	0D	
136 CL	0D	0	2
142 CL	0D	0	1D
148 CL	0D	2D	2047
154 Y	1801	0	0D
160 *	30	4	0
166 CH	1	?	2
172 MS	21	1	
177 MS	21	2	
182 Y	1805	262	1 1
189 J	2000	12	
194 Y	1803	263	1 1
201 J	2000	12	
206 Y	5844	-6	
211 D			
214 .			

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OF POOR QUALITY

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1 L	-51			
5 L	1000			
9 Y	5844	6		
14 Y	1805	20	1	1
21 S	100	102		
26 Y	1805	283	1	3
32 Y	1800	13	2601	
39 Y	1800	14	2611	
45 J	200	50		
50 Y	1800	64	2590	
56 MS	38	3		
61 MS	18			
65 MS	32	1		
70 Y	100	0	1	
76 Y	100	0	2	
82 Y	100	0	3	
85 Y	5814			
92 Y	5836	10		
97 Y	5819	2	1	
103 S				
106 MS	22	3	895	
112 Y	5819	11	1	
118 Y	5819	1	1	
124 MS	22	1		

KYBD STACK 51

o This routine acquires
data to the thru-put de-
vice (mag tape); tran-
scribes it to the disc
linearizes the data.

ORIGINAL PAGE IS
OF POOR QUALITY

129 MS	31	70						
134 MS	72							
138 MS	38	17						
143 MS	18							
147 Y	6020	199	2	201	56	0	-1	
157 MS	31	70						
162 MS	11							
166 Y	1823	1	0	0				
173 Y	5838	10						
178 Y	5819	3	1					
184 Y	6029	1D	84D	70	3	2D	4D	
194 Y	1800	13	159D					
200 Y	1800	14	70					
206 J	200	50						
211 D								
214 .								

**ORIGINAL PAGE IS
OF POOR QUALITY**

KYBD STACK 59

o This routine determines
program branching to plot
compensated or uncompensa-
ted, time or frequency
domain data.

1 L	-37	
3 L	2000	
9 Y	5844	6
14 Y	5844	20
19 Y	3020	
23 MS	38	
27 MS	18	
31 MS	37	
35 MS	17	
39 Y	1805	20
46 J	100	104
51 J	9999	
55 L	2005	
59 Y	3010	
63 Y		
66 J	2005	
70 L	9999	
74 Y	5842	2
79 Y	5844	
84 Y	5844	20
89 Y	3010	
93 J	9998	
97 Y	3010	
101 MS	37	

105 MS	27			
109 Y	5844	-6		
114 Y	5844	-20		
119 Y	3020			
123 <				
126 L	9998			
130 Y	1805	265	1	1
137 J	200	-1		
142 Y	1805	282	1	3
149 MS	31	4		
154 MS	11			
158 J	150	-1		
163 MS	31	9		
168 MS	11			
172 TR				
175 *-				
178 X>	1			
182 MS	31	3		
187 MS	11			
191 Y	1805	264	1	1
196 :	1			
202 L	150			
206 J	200	13		
211 L	999			

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OF POOR QUALITY

ORIGINAL PAGE IS
OF POOR QUALITY

215 D				
218 J	999	-1		
223 L	200			
227 Y	1805	264	1	2
234 J	100	17		
239 J	999	-1		
244 Y	1800	0	266D	
250 Y	6007	4		
255 L	300			
259 MS	31	00		
264 MS	11			
268 D				
271 J	100	36		
276 Y	1805	270	1	1
283 J	100	13		
288 Y	1801	0	00	3
295 J	300	2675	0	
301 Y	5814			
305 Y	5836	10		
310 Y	5819	6	1	
316 J	999	-1		
321 .				

1 L	-100			
5 L	100			
9 Y	5844			
14 Y	1800	20	0	
20 MS	37			
24 MS	27			
28 Y	1800	54	51	
34 Y	1800	55	100	
40 L	1505			
44 Y	5838	51		
49 Y	5814			
53 Y	5819	99	1	
59 J	1500	20		
64 Y	1805	19	1	1
71 J	1505	-1		
76 L	1510			
80 J	2000	11		
85 Y	5844	-3		
90 Y	5844	-4		
95 Y	5844	-20		
100 L	1511			
104 D				
107 J	1511			
111 L	1			

KYBD STACK 100

o Edit routine theoretical H(f)

ORIGINAL PAGE IS
OF POOR QUALITY

115 Y	1805	180	1809	2
122 Y	5819	1	1	
128 <				
131 J	1500	110		
136 Y	1800	54	51	
142 Y	1800	53	100	
148 Y	5838	51		
153 Y	5819	99	1	
159 <				
162 L	0			
166 J	11	1	1	
172 J	12	1	1	
178 J	13	1	1	
184 J	14	1	1	
190 J	15	1	1	
196 J	21	1	1	
202 J	22	1	1	
208 J	23	1	1	
214 J	24	1	1	
220 J	100	1	1	
226 Y	1805	480	1	2
233 Y	5814			
237 J	10	-1		
242 <				

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OF POOR QUALITY

ORIGINAL PAGE IS
OF POOR QUALITY

245 L	10		
249 J	25	1	1
255 J	26	1	1
261 J	27	1	1
267 J	28	1	1
273 J	29	1	1
279 J	30	1	1
285 <			
288 L	11		
292 L	12		
296 L	13		
300 L	14		
304 L	15		
308 L	20		
312 L	21		
316 L	22		
320 L	23		
324 L	24		
328 L	25		
332 L	26		
336 L	27		
340 L	28		
344 L	29		
348 L	30		
352 J	330	1	1
358 <			
361 .			

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OF POOR QUALITY

KYBD STACK 101

o Edit routine - theoreti
H(f)

1 L	-101		
5 L	11		
9 Y	5819	11	1
15 Y	180D	199	
20 <			
23 L	12		
27 Y	5819	12	1
33 Y	180D	203	204
39 <			
42 L	13		
46 Y	5819	13	1
52 Y	180D	205	206
58 <			
61 L	14		
65 Y	5819	14	1
71 Y	180D	207	208
77 <			
80 L	15		
84 Y	5819	15	1
90 Y	180D	209	210
96 <			
99 L	21		
103 Y	5819	21	1
109 Y	180D	211	212

ORIGINAL PAGE IS
OF POOR QUALITY

115	<			
118	L	222049 1000000		
		VILAUD 9 10 10		
122	Y	5819	22	1
128	Y	180D	213	214
134	<			
137	L	23		
141	Y	5819	23	1
147	Y	180D	215	216
153	<			
156	L	24		
160	Y	5819	24	1
166	Y	180D	201	202
172	<			
175	L	25		
179	Y	5819	25	1
185	Y	180D	217	216
191	<			
194	L	26		
198	Y	5819	26	1
204	Y	180D	219	220
210	<			
213	L	27		
217	Y	5819	27	1
223	Y	189D	245	246

229 <

232 L 28

ORIGINAL PAGE IS
OF POOR QUALITY

236 Y 5819 28 1

242 Y 180D 221 222

248 <

251 L 29

255 Y 5838 50

260 Y 5819 29 1

266 Y 180D 200

271 Y 5838 51

276 <

279 L 30

283 Y 5838 50

288 Y 5819 30 1

294 Y 180D 198

299 Y 5838 1

304 <

307 L 100

311 Y 5838 8

316 Y 5819 94 1

322 Y 5838 51

327 Y 1808 480

332 <

335 .

ORIGINAL PAGE IS
OF POOR QUALITY

KYBD STACK 102

o Edit routine - measured
H(f)

1 L	-102		
5 L	100		
9 Y	5844	3	
14 Y	1800	20	0
20 MS	37		
24 MS	27		
28 Y	1800	54	52
34 Y	1800	55	103
40 L	1505		
44 Y	5838	52	
49 Y	5814		
53 Y	5819	99	1
59 J	1500	20	
64 Y	1805	19	1
71 J	1505	-1	
76 L	1510		
80 J	2000	11	
85 Y	5844	-3	
90 Y	5844	-6	
95 Y	5844	-20	
100 L	1511		
104 D			
107 J	1511		
111 L	1		

115 Y	1805	180	1809	2
122 Y	5819	1	1	
128 <				
131 Y	1800	54	52	
137 Y	1800	55	103	
143 Y	5819	99	1	
149 <				
152 L	0			
156 J	0	103		
161 <				
164 .				

**ORIGINAL PAGE IS
OF POOR QUALITY**

1 L	-103			
5 L	0			
9 J	5	1	1	
15 J	6	1	1	
21 J	7	1	1	
27 J	8	1	1	
33 J	9	1	1	
39 J	13	1	1	
45 J	14	1	1	
51 J	15	1	1	
57 J	100	2	1	
63 Y	1805	480	1	2
70 Y	5814			
74 J	99	-1		
79				
82 L	99			
86 Y	5838	55		
91 J	10	2	1	
97 J	11	2	1	
103 J	12	2	1	
109 J	20	2	1	
115 J	21	2	1	
121 J	22	2	1	
127 J	30	2	1	

KYBD STACK 103

o Edit routine - measured
H(f)

ORIGINAL PAGE IS
OF POOR QUALITY

133 J	31	2	1
139 J	32	2	1
145 K			
148 L	5		
152 L	6		
156 L	7		
160 L	8		
164 L	9		
168 L	13		
172 L	14		
176 L	15		
180 Y	5838	32	
185 J	53D	104	
190 K			
193 L	10		
197 L	11		
201 L	12		
205 L	20		
209 L	21		
213 L	22		
217 L	30		
221 L	31		
225 L	32		
229 Y	5838	55	
234 J	53D	105	
239 K			
242 .			

ORIGINAL PAGE IS
OF POOR QUALITY

1 L -104

KYBD STACK 104

5 L 5

9 Y 5819 5 1

o Edit routine - measured
H(f)

15 Y 1800 223 224

21 <

24 L 6

ORIGINAL PAGE 18
OF POOR QUALITY

28 Y 5819 6 1

34 Y 1800 283

39 <

42 L 7

46 Y 5819 7 1

52 Y 1800 259

57 <

60 L 8

64 Y 5819 8 1

70 Y 1800 261

75 <

78 L 9

82 Y 5819 9 1

88 Y 1800 260

93 <

96 L 13

100 Y 5819 13 1

106 Y 1800 262

111 <

114 L 14

118 Y 5819 14 1

124 Y 180D 263

129 <

132 L 15

136 Y 5819 15 1

142 Y 180R 243 244

148 <

151 .

**ORIGINAL PAGE IS
OF POOR QUALITY**

1 L	-105		
3 L	10		
9 Y	5819	10	1
15 Y	180D	225	226
21 <			
24 L	11		
28 Y	5819	11	1
34 Y	180D	227	228
40 <			
43 L	12		
47 Y	5819	12	1
53 Y	180D	229	230
59 <			
62 L	20		
66 Y	5819	20	1
72 Y	180D	231	232
78 <			
81 L	21		
85 Y	5819	21	1
91 Y	180D	233	234
97 <			
100 L	22		
104 Y	5819	22	1
110 Y	180D	235	236

KYBD STACK 105

o Edit routine - measured
H(f)

ORIGINAL PAGE 18
OF POOR QUALITY

116	<			
119	L	30		
123	Y	5819	30	1
129	Y	180D	237	238
135	<			
138	L	31		
142	Y	5819	31	1
146	Y	180D	239	240
154	<			
157	L	32		
161	Y	5819	32	1
167	Y	180D	241	242
173	<			
176	L	100		
180	Y	5838	8	
185	Y	5819	94	1
191	Y	5838	52	
196	Y	1808	480	
201	<			
204	.			

ORIGINAL PAGE IS
OF POOR QUALITY

1 L -106

KYBD STACK 106

5 L 100

9 Y 5844

o Edit routine - Processing
and plotting.

14 Y 1800

6
APPROX
-20.0

0

20 MS 37

24 MS 27

28 Y 1800

54

53

34 Y 1800

55

107

40 L 1505

44 Y 5838

53

49 Y 5814

53 Y 5819

99

1

59 J 1500

20

64 Y 1805

19

1

1

71 J 1505

-1

76 L 1510

80 J 2000

11

85 Y 5844

-3

90 Y 5844

-6

95 Y 5844

-20

100 L 1511

104 D

107 J 1511

111 L 1

ORIGINAL PAGE IS
OF POOR QUALITY

115 Y	1805	180	1809	2
122 Y	5819	1	1	
128 <				
131 Y	1800	54	52	
137 Y	1800	55	107	
143 Y	5819	99	1	
149 <				
152 L	0			
156 J	0	107		
161 <				
164 .				

ORIGINAL PAGE IS
OF POOR QUALITY

1 L -107

KYBD STACK 107

5 L 0

u Edit routine - processing
and plotting.

9 J 10 1 1

15 J 20 1 1

21 J 21 1 1

27 J 22 1 1

33 J 23 1 1

39 J 24 1 1

45 J 25 1 1

51 J 26 1 1

57 J 30 1 1

63 J 31 1 1

69 J 32 1 1

75 J 100 2 1

81 Y 1805 480 1 2

88 Y 5814

92 J 999 -1

97 <

100 L 999

104 J 35 2 1

110 J 36 2 1

116 J 37 2 1

122 J 40 2 1

128 J 41 2 1

ORIGINAL PAGE IS
OF POOR QUALITY

134 J	51	2	1
140 J	52	2	1
146 <			
149 L	10		
153 L	20		
157 L	21		
161 L	22		
165 L	23		
169 L	24		
173 L	25		
177 L	26		
181 L	30		
185 L	31		
189 L	32		
193 J	53D	108	
198 <			
201 L	35		
205 L	36		
209 L	37		
213 L	40		
217 L	41		
221 L	51		
225 L	52		
229 J	53D	109	
234 <			
237 .			

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1 L	-108		
5 L	10		
9 Y	5819	10	1
15 Y	180D	264	
20 <			
23 L	20		
27 Y	5819	20	1
33 Y	180D	265	
38 <			
41 L	21		
45 Y	5819	21	1
51 Y	180D	266	
56 <			
59 L	22		
63 Y	5819	22	1
69 Y	180D	267	
74 <			
77 L	23		
81 Y	5819	23	1
87 Y	180D	268	
92 <			
95 L	24		
99 Y	5819	24	1
105 Y	180D	269	

KYBD STACK 108

o Edit routine - processing and plotting.

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110 <

113 L 25

117 Y 5819 25 1

123 Y 180D 270

128 <

131 L 26

135 Y 5819 26 1

141 Y 180D 282

146 <

149 L 30

153 Y 5819 30 1

159 Y 180D 271

164 <

167 L 31

171 Y 5819 31 1

177 Y 180D 272 273

183 <

186 L 32

190 Y 5819 32 1

196 Y 180D 274 275

202 <

205 .

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1 L	-109		
5 L	35		
9 Y	5838	54	
14 Y	5819	35	1
20 Y	180D	276	
25 <			
28 L	36		
32 Y	5838	54	
37 Y	5819	36	1
43 Y	180D	277	278
49 <			
52 L	37		
56 Y	5838	54	
61 Y	5819	37	1
67 Y	180D	279	280
73 <			
76 L	40		
80 Y	5838	54	
85 Y	5819	40	1
91 Y	180D	281	
96 <			
99 L	41		
103 Y	5838	54	
108 Y	5819	41	1

KYBD STACK 109

o Edit routine - processing
and plotting.

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114	<				
117	L	51			
121	Y	1800	1	39D	
127	Y	5838	34		
132	Y	5819	13	1	
138	Y	5838	35		
143	Y	1805	180	1809	2
150	Y	5819	1D	1	
156	<				
159	Y	5803	35	1D	
165	<				
168	L	52			
172	Y	1801	1	39D	10
179	Y	5838	34		
184	Y	5819	14	1	
190	Y	5838	35		
195	Y	1805	180	1809	2
202	Y	5819	1D	1	
208	<				
211	Y	5803	35	1D	
217	<				
220	L	100			
224	Y	5838	8		
229	Y	5819	94	1	
235	Y	5838	53		
240	Y	1808	480		
245	<				
248	.				

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1.2 Fortran Routines

PROGRAM	DEFINITION
Y 6020	Inputs user edits to array 'XIN'
Y 6021	Inputs T/C & gas stream Equation coef's to array 'C'
Y 6022	Evaluates T/C wire parameters
Y 6023	Evaluates gas stream parameters
Y 6024	Evaluates $H(f)$ - (T/C wire/gas stream)
Y 6026	Evaluates $H(f)$ - (large wire/small wire)
Y 6027	Evaluates measured value of ΔH_{MA}
Y 6028	Converts millivolts to degrees fahrenheit
Y 6029	Modified version of 'Y 6028' for 'HOST'
Y 6030	Connects points in the data block

SUBROUTINE Y6020(I,JBUF)

```

C
C Y 6020 N1 N2 N3 N4 N5 N6 PASSES VARIABLE PARAMETER VALUES
C TO THE FORTRAN USER BUFFER BY USING A DOUBLE PRECISION
C DATA BLOCK AS THE INTERMEDIATE BUFFER. WHAT THIS PRO-
C GRAM DOES IS REMOVE THE 6 'END CODE' LIMITATION BY STORING
C THESE VARIABLE PARAMETER VALUES IN AN ARRAY CALLED 'XIN' AND
C PASSING THIS ARRAY THRU COMMON. A MAXIMUM OF 60 VARIABLE
C PARAMETERS CAN BE PASSED.
C
C REAL VARIABLES USE 2 INTEGER VARIABLE PARAMETERS FOR EACH
C VARIABLE. THAT IS, THE REAL VARIABLE MUST BE STORED IN TWO
C INTEGER VARIABLE PARAMETERS, ONE FOR THE MANTISSA AND ONE
C FOR THE POWER OF 10.
C
C INTEGER VARIABLES USE ONE INTEGER VARIABLE PARAMETER PER
C VARIABLE.
C
C THE PROGRAM ACCEPTS ANY COMBINATION OF VARIABLES, THAT IS,
C REAL ONLY, INTEGER ONLY OR BOTH BY SETTING A FLAG.
C
C Y 6020 IS FORMATTED PER BELOW:
C
C N1 = INTEGER VARIABLE PARAMETER STARTING VP #
C N2 = NUMBER OF INTEGER VARIABLES
C N3 = REAL VARIABLE STARTING VP#
C N4 = NUMBER OF REAL VARIABLES
C N5 = BLOCK # TO USE AS INTERMEDIATE BUFFER
C N6 = FLAG - -1 = BOTH, 0 = REAL ONLY, 1 = INTEGER ONLY
C
C PROGRAM EXECUTION PRE-REQUISITES: NONE
C
C NOTE! THE 'COMMON' VARIABLES AND ARRAYS REFERENCED IN THIS
C PROGRAM WILL CHANGE WHEN USED IN DIFFERENT OVERLAYS. HOWEVER,
C THE REMAINING SOFTWARE WILL REMAIN UNCHANGED.
C
C PAUL T. PURPURA - 07/19/82
C
      DIMENSION JBUF(6),MQUAL(5)
      COMMON XIN(30),A(2),K(2),C(45),TC(4),GS(10),TP(10)
      COMMON FRQ
      N1=JBUF(1)
      N2=JBUF(2)
      N3=JBUF(3)
      N4=JBUF(4)
      N5=JBUF(5)
      N6=JBUF(6)
      MQUAL(1)=64
      MQUAL(2)=12
      MQUAL(3)=32767
      MQUAL(4)=42
      MQUAL(5)=0
      IEMP=0.
      ITEMP=0.
      IEMP=0
      DO 10 I2=1,30
        XIN(I2)=0.
      10 CONTINUE

```

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```
30 CALL KYBD(041514B,N5)
   CALL PUTR(N5,MQUAL)
   IF(N6) 30,40,30
   IVP=N1
   DO 35 ICTI=1,N2
   CALL KYBD(054440B,1822,IVP,N5,1)
   CALL GET(N5,1,TEMP,GUNK)
   XIN(ICTI)=TEMP
   IVP=IVP+1
35 CONTINUE
   IF(N6) 40,40,99
40 IVP=N3
   N4=N4/2
   DO 45 ICTR=ICTI,N4
   CALL KYBD(054440B,1822,IVP,N5,1)
   CALL GET(N5,1,TEMP,GUNK)
   CALL KYBD(054440B,1822,IVP+1,N5,1)
   CALL GET(N5,1,TTEMP,BUNK)
   XIN(ICTR)=TEMP*(10.**TTEMP)
   IVP=IVP+2
45 CONTINUE
99 CALL KYBD(041123B,204B)
   RETURN
   END
   END#
```

FTN4.1

SUBROUTINE Y6021(I,JBUF)

C
C Y 6021 SETS UP AN ARRAY CALLED 'C' WHICH CONTAINS THE CO-
C EFFICIENTS FOR THE THERMOCOUPLE WIRE (Pt/6%Rh & Pt/30%Rh)
C AND GAS STREAM EQUATIONS AND PASSES THEM THROUGH COMMON
C TO 'Y 6023' AND 'Y 6024'.
C

C PROGRAM EXECUTION PRE-REQUISITES: Y 6020

C
C PAUL T. PURPURA - 07/19/82
C

COMMON XIN(30),A(2),K(2),C(45),TC(4),GS(10),TP(10)

COMMON FRQ

DO 10 IZ=1,45

C(IZ)=0.

10 CONTINUE

C(1)=3.8926*10.**(-1)

C(2)=1.8746*10.**(-3)

C(3)=2.1226*10.**(-6)

C(4)=-2.7926*10.**(-10)

C(5)=3.2070*10.**(-2)

C(6)=4.8648*10.**(-6)

C(7)=-3.8201*10.**(-13)

C(8)=-1.0204*10.**(-13)

C(9)=-2.6336*10.**(-4)

C(10)=-2.4880*10.**(-8)

C(11)=1.4592*10.**(-11)

C(12)=-1.587*10.**(-15)

C(13)=3.0239*10.**(-1)

C(14)=1.0526*10.**(-2)

C(15)=-1.8102*10.**(-6)

C(16)=1.1490*10.**(-10)

C(17)=-3.9228*10.**(-2)

C(18)=4.8327*10.**(-6)

C(19)=-3.3457*10.**(-9)

C(20)=-1.7809*10.**(-12)

C(21)=2.2544*10.**(-16)

C(22)=1.9764*10.**(-4)

C(23)=3.2121*10.**(-8)

C(24)=-1.5888*10.**(-11)

C(25)=2.9097*10.**(-15)

C(26)=1.8998*10.**(-5)

C(27)=1.4023*10.**(-2)

C(28)=2.7857*10.**(-5)

C(29)=2.4733*10.**(-1)

C(30)=-3.4000*10.**(-5)

C(31)=1.3750

C(32)=1.9429*10.**(-5)

C(33)=1.4041*10.**(-2)

C(34)=2.7400*10.**(-5)

C(35)=2.4413*10.**(-1)

C(36)=-3.4500*10.**(-5)

C(37)=1.3690

C(38)=1.9859*10.**(-5)

C(39)=1.4062*10.**(-2)

C(40)=2.7091*10.**(-5)

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C(41)=2.3937*10.**(-1)
C(42)=-7 5000*10.**(-5)
C(43)=1. 530
C(44)=9.0420*10.**(-9)
C(45)=1.6100*10.**(-5)
RETURN
END
END\$

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FIN4:1

SUBROUTINE Y6022(I,JBUF)

C
C Y 6022 CALCULATES THE FOLLOWING THERMOCOUPLE WIRE PARA-
C METERS AND OUTPUTS THEM INTO THE ARRAY 'TC' WHICH IS
C PASSED THROUGH COMMON.
C
C 1. DENSITY (RHO)
C 2. THERMAL CONDUCTIVITY (XK)
C 3. SPECIFIC HEAT (CP)
C 4. THERMAL DIFFUSIVITY (AL)
C
C THE VALUE OF 'XIN(8)' DETERMINES WHICH SET OF EQUATIONS
C WILL BE USED.
C
C 1. WHEN 'XIN(8)' IS '0' THEN EQUATIONS FOR Pt/6%Rh TC'S
C WILL BE USED.
C
C 2. WHEN 'XIN(8)' IS '1' THEN EQUATIONS FOR Pt/30%Rh TC'S
C WILL BE USED.
C
C PROGRAM EXECUTION PREREQUISITES: Y 6020, Y 6021
C
C PAUL T. PURPURA - 07/19/82
C

COMMON XIN(30),A(2),K(2),C(45),TC(4),GS(10),TF(10)
COMMON FRQ
GO TO IZ=1,10
TC(IZ)=0.
10 CONTINUE
T=XIN(8)
IF(XIN(1)) 99,20,30
20 RHO=1278.7
XK=C(1)+C(2)*T+C(3)*T**2+C(4)*T**3
CP=C(5)+C(6)*T+C(7)*T**2+C(8)*T**3
AL=C(9)+C(10)*T+C(11)*T**2+C(12)*T**3
GO TO 40
30 RHO=1092.1
XK=C(13)+C(14)*T+C(15)*T**2+C(16)*T**3
CP=C(17)+C(18)*T+C(19)*T**2+C(20)*T**3+C(21)*T**4
AL=C(22)+C(23)*T+C(24)*T**2+C(25)*T**3
40 TC(1)=RHO
TC(2)=XK/3600.
TC(3)=CP
TC(4)=AL
99 RETURN
END
END\$

SUBROUTINE Y60234T(JBUF)

```

C
C Y6023 CALCULATES THE FOLLOWING GAS STREAM PARAMETERS AND
C OUTPUTS THEM INTO THE ARRAY 'GS' WHICH IS PASSED THROUGH
C COMMON.
C
C 1. DENSITY (RHO)
C 2. THERMAL CONDUCTIVITY (K)
C 3. SPECIFIC HEAT (CP)
C 4. SPECIFIC HEAT RATIO (GA)
C 5. VISCOSITY (XMU)
C 6. SONIC VELOCITY (C)
C 7. KINETIC VISCOSITY (G)
C 8. PRANDTL NUMBER (PR)
C 9. MEAN GAS VELOCITY (U)
C 10. AERODYNAMIC PARAMETER (GMA)
C
C EQUATIONS USED TO CALCULATE PARAMETERS 2, 3, AND 4 ARE DEPENDENT
C ON THE FUEL TO AIR RATIO (XIN(3)).
C
C PROGRAM EXECUTION PRE-REQUISITES: Y 6021
C
C PAUL T. PURPURA - 07/20/82
C
COMMON XIN(30),A(2),K(2),C(45),TC(4),GS(10),TF(10)
COMMON FRQ
DO 10 IZ=1,10
  GS(IZ)=0.
10 CONTINUE
  I=XIN(8)
  F=XIN(9)
  XM=XIN(10)
  FA=XIN(3)
  XL1=.015
  XL2=.025
  IF(FA.LE.XL1) GO TO 20
  IF(FA.GT.XL1.AND.FA.LE.XL2) GO TO 30
  IF(FA.GT.XL2) GO TO 40
20 XK=C(26)*T+C(27)
  CP=C(28)*T+C(29)
  GA=C(30)*T+C(31)
  GO TO 50
30 XK=C(32)*T+C(33)
  CP=C(34)*T+C(35)
  GA=C(36)*T+C(37)
  GO TO 50
40 XK=C(38)*T+C(39)
  CP=C(40)*T+C(41)
  GA=C(42)*T+C(43)
50 XMU=C(44)*T+C(45)
  RHO=2.6983*(P/(T+460.))
  C=41.454*(SQRT(GA*(T+460.)))
  G=XMU/RHO
  PR=3600.*XMU*CP/XK
  U=XM*C
  GMA=GMA/(SQRT(G)*TC(1)*TC(3))

```

GS(1)=RHO
GS(2)=XK
GS(3)=CF
GS(4)=GA
GS(5)=XMU
GS(6)=C
GS(7)=G
GS(8)=PR
GS(9)=U
GS(10)=GMA/3600.
A(1)=GS(10)
CALL XINTZ(X,IX,NP)
CALL KYBD(054440B,1800,243,K(1))
CALL KYBD(054440B,1800,244,K(2))
RETURN
END
END\$

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SUBROUTINE Y6024(I,JBUF)

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Y 6024 N1 N2 N3 EVALUATES TRANSFER FUNCTIONS PER BELOW
FOR N1 VALUES OF GAMMA AND STORES THEM IN FILE 1 STARTING AT
RECORD 10, FOR SMALL WIRE DATA, AND RECORD 30, FOR LARGE
WIRE DATA. A MAXIMUM OF 13 VALUES OF GAMMA ARE ALLOWED.

1. SMALL WIRE (GAIN AND PHASE) VS THE GAS STREAM
2. LARGE WIRE (GAIN AND PHASE) VS THE GAS STREAM

Y 6024 IS FORMATTED PER BELOW:

- N1 = THE NUMBER OF GAMMA VALUES
N2 = FLAG - 0 = .THEORETICAL GAMMA EVALUATED. GO FROM .5 TO 1.5
TIMES GAMMA IN .1 INC'S.
1 = .MEASURED GAMMA EVALUATED, LEAVE ALONE
N3 = FLAG - 0 = .EVALUATE PIECEWISE TRANSFORM, CH 1 TO 50 CON-
SECUTIVE, THEN EVERY 10TH CHANNEL, THEN CH 1023
1 = .EVALUATE SPECIFIED CHANNELS FROM EDITS

Y 6024 CALLS THE FOLLOWING SUBPROGRAMS:

1. TRFP - THIS SUBPROGRAM CALCULATES THE COEFFICIENTS FOR THE
TRANSFER PROGRAM "TRFM" AND PASSES THEM THROUGH
COMMON.
2. TRFM - THIS SUBPROGRAM EVALUATES THE TRANSFER FUNCTION.
3. XINTZ - THIS SUBPROGRAM CONVERTS ANY FLOATING POINT VAR-
IABLE TO AN INTEGER AND POWER OF 10.

PROGRAM EXECUTION PRE-REQUISITES: Y 6022,Y 6023 .

PAUL T. PURPURA - 09/04/82

```

DIMENSION JBUF(3),MQUAL(5)
COMMON XIN(30),A(2),K(2),C(45),TC(4),GS(10),TP(10)
COMMON FRQ
N1=JBUF(1)
N4=JBUF(2)
N5=JBUF(3)
IF(N4)81,81,82
T=XIN(11)+.00001
GO TO 83
T=XIN(14)+.00001
IF(N5)4,4,5
N2=1
N7=1023
N8=1
GO TO 7
CHN=XIN(12)/XIN(11)
N2=CHN+.05
CHN=XIN(13)/XIN(11)
N8=CHN+.05
CHN=XIN(25)/XIN(11)
N7=CHN+.05
MQUAL(1)=2048
MQUAL(2)=5
MQUAL(3)=32767
    
```

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```
IF(T-.5)63,61,61
61 IF(T-1.)64,62,62
62 IF(T-2.)65,66,66
63 MQUAL(4)=49
GO TO 70
64 MQUAL(4)=53
GO TO 70
65 MQUAL(4)=57
GO TO 70
66 MQUAL(4)=61
70 MQUAL(5)=0
DGMA=.5
IC1=N2
DO 9 IA=4,7
XIN(IA)=XIN(IA)/12.
9 CONTINUE
DO 10 IZ=1,11
CALL KYBD(041514B,IZ)
CALL PUTQ(IZ,MQUAL)
10 CONTINUE
CALL KYBD(054440B,5838,1)
DO 30 IG=1,N1
OLDPHS=0.
IF(N4)1,1,2
1 TGMA=GS(10)*DGMA
GO TO 3
2 TGMA=GS(10)
3 DO 20 IC=N2,N7,N8
IF(N5)6,6,15
6 IF(IC-1023)11,15,15
11 IF(IC-50)12,13,13
12 IC1=IC1+1
GO TO 15
13 IF(IC-IC1)20,14,14
14 IC1=IC1+10
15 A(2)=TGMA
XIC=IC
FRQ=1*XIC
CALL TRFF(X)
CALL TRFM(X,Y)
IF(OLDPHS-A(2))16,16,17
16 A(2)=OLDPHS
GO TO 18
17 OLDPHS=A(2)
18 CALL PUT(IG,IC,A(1),A(2))
CALL KYBD(054440B,5819,1,1)
A(1)=FRQ
CALL XINTZ(X,IX,NF)
CALL KYBD(054440B,1800,1,K(1))
CALL KYBD(054440B,1800,2,K(2))
CALL KYBD(054440B,1809,1,2)
IF(N4)19,19,20
19 A(1)=DGMA
CALL XINTZ(X,IX,NF)
CALL KYBD(054440B,1800,1,K(1))
CALL KYBD(054440B,1800,2,K(2))
CALL KYBD(054440B,1809,1,2)
20 CONTINUE
DGMA=DGMA+.1
CONTINUE
```

31 IF(N4)31,31,50
35 IF(XIN(2))35,35,36
CALL KYBD(046523B,31,10)
GO TO 37
36 CALL KYBD(046523B,31,30)
37 DO 40 IM=1,N1
CALL KYBD(046523B,21,IM)
40 CONTINUE
50 RETURN
END
END\$

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FTN4.1

SUBROUTINE Y6026(I,JBUF)

C
C Y 6026 N1 N2 N3 N4 EVALUATES THE TRANSFER FUNCTION BETWEEN
C 2 DATA BLOCKS.
C
C Y 6026 IS FORMATTED PER BELOW:
C
C N1 = NUMBER OF RECORDS (GAMMA VALUES)
C N2 = START POINTER IN FILE 1 FOR SMALL WIRE VS GAS STREAM H(f)
C N3 = START POINTER IN FILE 1 FOR LARGE WIRE VS GAS STREAM H(f)
C N4 = START POINTER IN FILE 1 FOR 10 MIL VS 3 MIL
C
C THE PROGRAM USES BLOCKS 0 AND 1 FOR COMPUTATIONS
C
C PROGRAM EXECUTION PREREQUISITES: Y 6024 (TWICE)
C
C PAUL T. PURPURA - 09/14/82
C

DIMENSION JBUF(4),MQUAL(5)
COMMON XIN(30)
N1=JBUF(1)
N4=JBUF(2)
N5=JBUF(3)
N6=JBUF(4)
MQUAL(1)=2048
MQUAL(2)=5
MQUAL(3)=32767
MQUAL(4)=61
MQUAL(5)=0
IS=N6
CALL KYBD(041514B,2)
CALL PUTR(2,MQUAL)
DO 30 IR=1,N1
CALL KYBD(046523B,31,N4)
CALL KYBD(046523B,11)
CALL KYBD(046523B,31,N5)
CALL KYBD(046523B,11,1)
XL=XIN(12)/XIN(11)
XU=XIN(25)/XIN(11)
XI=XIN(13)/XIN(11)
IL=XL+.05
IU=XU+.05
IN=XI+.05
DO 20 IC=IL,IU,IN
CALL GET(0,IC,G3,P3)
CALL GET(1,IC,G10,P10)
TF10T3=G10/G3
PH10T3=P10-P3
I=ABS(PH10T3)
IF(180.-I)10,13,13
IF(PH10T3)11,12,12
10 PH10T3=PH10T3-360.
GO TO 13
11 PH10T3=PH10T3+360.
12
13 CALL PUT(2,IC,TF10T3,PH10T3)
20 CONTINUE

N4=N4+1
N5=N5+1
CALL KYBD(046523B,31,18)
CALL KYBD(046523B,21,2)
IS=IS+1
CONTINUE
RETURN
END
END*

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SUBROUTINE Y6027(I,JBUF)

C
 C Y 6027 N1 N2 N3 N4 N5 N6 DETERMINES THE MEASURED VALUE OF GAMMA
 C AND STORES IT IN 'GS(10)' FOR EVALUATION OF THE MEASURED TRANS-
 C FER FUNCTION. IT IS FORMATTED PER BELOW:
 C
 C N1 = FLAG - 0 = READ GAMMA FROM COMMON, 1 = CALCULATE GAMMA.
 C N2 = STARGING RECORD # IN FILE 1 FOR LARGE/SMALL WIRE H(f).
 C N3 = NUMBER OF THEORETICAL X-FER FUNC. RECORDS
 C N4 = SCRATCH BLOCK FOR THEORETICAL DATA.
 C N5 = BLOCK WHERE MEASURED X-FER FUNC RESIDES
 C N6 = BLOCK WHERE COHERENCE FUNC. RESIDES.
 C
 C IT PERFORMS THE FOLLOWING DATA CHECKS:
 C
 C 1. DETERMINES IF THE MEASURED GAIN CROSSES THE THEORETICAL X-FER
 C FUNCTION CURVE.
 C
 C 2. DETERMINES IF THE COHERENCE IS WITHIN SPECIFIED LIMITS OF
 C .8<Y**2<1.005.
 C
 C 3. DETERMINES IF A COMBINATION OF ABOVE ERRORS WOULD RESULT IN
 C NOT HAVING A MEASURED VALUE OF GAMMA.
 C
 C IN EACH OF THE ABOVE CASES, A MESSAGE IS DISPLAYED ON THE
 C TERMINAL TO FLAG THE OPERATOR. IF A MEASURED VALUE OF GAMMA
 C IS NOT DETERMINED, PROCESSING STOPS AND THE OPERATOR IS AD-
 C VISED TO CORRECT THE PROBLEM AND REPEAT THE ACQUISITION.
 C
 C PROGRAM EXECUTION PRE-REQUISITES: Y 6020,Y 6021,Y 6022,Y 6023
 C
 C PAUL T. PURPURA - 09/27/82
 C

DIMENSION JBUF(6)
 COMMON XIN(30),A(2),K(2),C(45),TC(4),GS(10),TP(10)
 COMMON PRQ
 N1=JBUF(1)
 N2=JBUF(2)
 N3=JBUF(3)
 N4=JBUF(4)
 N5=JBUF(5)
 N6=JBUF(6)
 TP(N1)10,10,20
 10 GS(10)=XIN(24)
 GO TO 99
 20 AVC=0.
 Y2L=.8
 AVGMA=0.
 Y2U=1.005
 IRH=N2+N3-1
 FA=XIN(11)/XIN(14)
 NF=FA
 XL=(FA*XIN(12))/XIN(11)
 XU=FA*XIN(25)/XIN(11)
 IL=XL+.05
 IU=XU+.05
 TN=FA*XIN(13)/XIN(11)
 IN=TN+.05
 CALL NYBD(054440B,5838,1)

DO SOLID-ILYIUM IN

IT=IC/NF

CALL GET(N5,IC,GN,PH)

DO 40 IR=N2,IRH

IRT=IR+1

CALL KYBD(046523B,31,IR)

CALL KYBD(046523B,11,N4)

CALL GET(N4,IT,V1,P1)

CALL KYBD(046523B,31,IRT)

CALL KYBD(046523B,11,N4)

CALL GET(N4,IT,V2,P2)

IF(GN-V1)40,31,31

31 IF(V2-GN)40,41,41

40 CONTINUE

GO TO 44

41 CALL GET(N6,IC,Y2,PP)

IF(Y2-Y2L)44,42,42

42 IF(Y2U-Y2)44,43,43

43 XIR=IR

XN2=N2

R1=.5+.1*(XIR-XN2)

AUGMA=AUGMA+R1+(GN-V1)*(.1)/(V2-V1)

AUC=AUC+1.

GO TO 50

44 XIC=IC

FR=XIC*XIN(14)

A(1)=FR

CALL XINTZ(X,IX,NP)

CALL KYBD(054440B,5819,8,1)

CALL KYBD(054440B,1800,1,K(1))

CALL KYBD(054440B,1800,2,K(2))

CALL KYBD(054440B,1809,1,2)

CALL KYBD(054440B,5819,1,1)

50 CONTINUE

IF(AUC)55,55,60

55 CALL KYBD(054440B,5819,10,1)

CALL KYBD(042040B,0)

60 AUGMA=AUGMA/AUC

A(1)=GS(10)

CALL XINTZ(X,IX,NP)

CALL KYBD(054440B,1800,1,K(1))

CALL KYBD(054440B,1800,2,K(2))

CALL KYBD(054440B,5819,4,1)

CALL KYBD(054440B,1809,1,2)

CALL KYBD(054440B,5819,1,1)

GS(10)=GS(10)*AUGMA

A(1)=GS(10)

CALL XINTZ(X,IX,NP)

CALL KYBD(054440B,1800,243,K(1))

CALL KYBD(054440B,1800,244,K(2))

CALL KYBD(054440B,5819,11,1)

CALL KYBD(054440B,1809,243,244)

CALL KYBD(054440B,5819,1,1)

59 RETURN

END

END

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FTN4:1

SUBROUTINE Y6028(I,JBUF)

C

C Y 6028 N1 N2 N3 N4 N5 N6 CONVERTS MILLIVOLTS TO DEG-FARENHEIT
C BY USE OF N.B.S. TEMPERATURE CURVES. DATA CAN BE FILTERED BUT
C NOT WINDOWED. IT READS DATA FROM FILE 1 ON THE DISC CONVERTS IT
C TO TEMPERATURE AND STORES IN THE SAME RECORD NUMBER THAT IT WAS
C REMOVED FROM.

C

C N1 = BLOCKSIZE

C N2 = # OF THRU-PUT RECORDS

C N3 = STARTING RECORD IN FILE 1

C N4 = TC CODE FLAG* 1 = CR/AL, 2 = PT/10ZRH, 3 = PT6Z/PT30Z

C 4 = CU/CON

C N5 = COORDINATE CODE

C N6 = FREQUENCY CODE

C

C THIS PROGRAM USES DATA BLOCKS 0 AND 1 FOR COMPUTATIONS. DATA
C MUST BE SCALED TO MILLIVOLTS PEAK.

C

C THIS PROGRAM CALLS 2 SUBPROGRAMS:

C

C 1. 'TCDEF' - WHICH INPUTS ALL TC CURVE EQUATION COEFFICIENTS.

C

C 2. 'TCALC' - WHICH CALCULATES TEMPERATURE FROM THE APPROPRIATE
C TC CURVE.

C

C PAUL T. PURPURA - 09/14/82

C

DIMENSION JBUF(6),MQUAL(5)

COMMON XIN(30),A(2),K(2),TCF(11,9),IFL

N1=JBUF(1)

N2=JBUF(2)

N3=JBUF(3)

N4=JBUF(4)

N5=JBUF(5)

N6=JBUF(6)

MQUAL(1)=N1

MQUAL(2)=N5

MQUAL(3)=32767

MQUAL(4)=N6

MQUAL(5)=0

CALL KYBD(041514B,1)

CALL PUTQ(1,MQUAL)

IFL=N4

CALL TCDEF(Z)

CALL KYBD(054440B,5838,1)

DO 20 IR=1,N2

CALL KYBD(046523B,31,N3)

CALL KYBD(046523B,11)

CALL KYBD(054440B,1800,0,N3)

CALL KYBD(054440B,5819,7,1)

CALL KYBD(054440B,1809,0)

CALL KYBD(054440B,5819,1,1)

DO 10 IC=1,N1

CALL GET(0,IC-1,A(1),CRAP)

CALL TCALC(Z)

CALL PUT(1,IC-1,A(1),CRAP)

CONTINUE

10

CALL SYBD(044523E,31,N3)
CALL KYBD(046523E,21,1)

N3=N3+1
CONTINUE
RETURN
END
ENDH

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SUBROUTINE Y6029(I,JBUF)

C
C Y 6029 N1 N2 N3 N4 N5 N6 IS A MODIFIED VERSION OF 'Y 6028',
C WRITTEN ESPECIALLY FOR 'HOST'. UNLIKE 'Y 6028', WHICH LINEARIZES
C ONLY ONE RECORD AT A TIME AND DOES NO SCALING, 'Y 6029' REMOVES
C AMPLIFIER DC OFFSET AND SCALES THE DATA PRIOR TO LINEARIZATION.
C 2 RECORDS ARE AC DATA (LARGE & SMALL WIRE T/C) AND THE THIRD
C IS THE DC CHANNEL. AFTER REMOVAL OF DC OFFSET AND SCALING, THE
C PROGRAM ADDS THE DC TO THE AC, CONVERTS IT TO TEMPERATURE AND
C THEN REMOVES THE DC, LEAVING PEAK TEMPERATURE. THIS IS DONE TO
C BOTH AC CHANNELS.

C
C PAUL T. PURPURA - 10/28/82
C

```

      DIMENSION JBUF(6),MQUAL(5)
      COMMON XIN(30),A(2),K(2),TCF(11,9),IFL
      N1=JBUF(1)
      N2=JBUF(2)
      N3=JBUF(3)
      N4=JBUF(4)
      N5=JBUF(5)
      N6=JBUF(6)
      MQUAL(1)=N1
      MQUAL(2)=N5
      MQUAL(3)=32767
      MQUAL(4)=N6
      MQUAL(5)=0
      IFL=N4
      CALL TCOEF(Z)
      CALL KYBD(054440B,5838,1)
      DO 10 ICL=1,14
      CALL KYBD(041514B,ICL-1)
10    CONTINUE
      CALL PUTQ(0,MQUAL)
      CALL PUTQ(1,MQUAL)
      CALL PUTQ(2,MQUAL)
      CALL KYBD(046523B,31,N3)
      DO 30 IR=1,N2
      CALL KYBD(046523B,11,3)
      CALL KYBD(046523B,11,4)
      CALL KYBD(046523B,11,5)
      CALL KYBD(046523B,31,-3,1)
      CALL KYBD(054440B,1800,0,N3)
      N3=N3+1
      CALL KYBD(054440B,1800,1,N3)
      N3=N3+1
      CALL KYBD(054440B,1800,2,N3)
      N3=N3+1
      CALL KYBD(054440B,5819,7,1)
      CALL KYBD(054440B,1809,0,2)
      CALL KYBD(054440B,5819,1,1)

```

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```
DO 20 IC=1,N1
CALL GET(3,IC-1,D3M,CRAF)
CALL GET(4,IC-1,D10M,CRAF)
CALL GET(5,IC-1,DJC,CRAF)
D3M=D3M-XIN(17)
D10M=D10M-XIN(20)
DDC=DDC-XIN(23)
D3M=D3M*XIN(16)*(1000.)/XIN(15)
D10M=D10M*XIN(19)*(1000.)/XIN(18)
DDC=DDC*XIN(22)*(1000.)/XIN(21)
A(1)=DDC
CALL TCALC(Z)
TDC=A(1)
D3MDDC=D3M+DDC
D10MDC=D10M+DDC
A(1)=D3MDDC
CALL TCALC(Z)
T3MDDC=A(1)
A(1)=D10MDC
CALL TCALC(Z)
T10MDC=A(1)
T3M=T3MDDC-TDC
T10M=T10MDC-TDC
CALL PUT(0,IC-1,T3M,CRAF)
CALL PUT(1,IC-1,T10M,CRAF)
CALL PUT(2,IC-1,TDC,CRAF)
CONTINUE
CALL KYBD(046523B,21,0)
CALL KYBD(046523B,21,1)
CALL KYBD(046523B,21,2)
CONTINUE
RETURN
END
END$
```

1.3 Fortran Subroutines

SPCY	Evaluates sampling frequency for 'TRFM' and 'TRFP'
TCALC	Evaluates DEG-F for 'Y 6028' and 'Y 6029'
TCDEF	Inputs N.B.S. curves for 'Y 6028' and 'Y 6029'
TRFM	Evaluates H(f) algorithms for 'Y 6024'
TRFP	Evaluates H(f) coefficients for 'Y 6024'
XINTZ	Changes a floating point number to an integer & PWR 1

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```
FINA.VI
      SUBROUTINE SPCY(X)
C
C 'SPCY' IS A SUBPROGRAM THAT DETERMINES THE SAMPLING FREQUENCY
C AS A FUNCTION OF THE INPUT FREQUENCY. IT OUTPUTS THROUGH THE
C ARRAY 'A'.
C
C CALLING PROGRAMS: TRFP, TRFM
C
C PAUL T. PURPURA 08/30/82
C
      COMMON XIN(30),A(2),K(2),C(45),TC(4),GS(10),TF(10)
      COMMON FRQ
      F=FRQ+.00001
      IF(F-62.5)1,2,2
1      P=1./F
      T=P/(5.*10.**(-4))
      T1=T/4.
      I1=f1
      T1=I1
      A(1)=(T1+1.)*4.
      GO TO 3
2      A(1)=32.
3      RETURN
      END
      END$
```

SUBROUTINE TCALC(Z)

```
C
C 'TCALC' IS A SUBPROGRAM THAT CALCULATES TEMPERATURE FROM THE
C COEFFICIENTS IN THE ARRAY 'TCF' AND SPECIFIED THE TC CODE FLAG
C ENTERED IN 'Y 6028'.
C
C CALLING PROGRAM: Y 6028
C
C PAUL T. PURPURA - 09/14/82
C
COMMON XIN(30),A(2),K(2),TCF(11,9),IFL
IF(IFL.EQ.1)GO TO 10
IF(IFL.EQ.2)GO TO 20
IF(IFL.EQ.3)GO TO 30
IF(IFL.EQ.4)GO TO 40
CALL WHAT
10 IRL=1
GO TO 25
20 IRL=4
IRH=IRH+2
GO TO 50
30 IRL=7
IRH=IRL+3
GO TO 50
40 IRL=11
GO TO 60
50 DO 55 IR=IRL,IRH
IF(TCF(IR,1)-A(1))55,55,60
55 CONTINUE
60 XN=TCF(IR,2)*A(1)+TCF(IR,3)
DF=TCF(IR,4)+TCF(IR,5)*XN+TCF(IR,6)*XN**2+TCF(IR,7)*XN**3
DF=DF+TCF(IR,8)*XN**4+TCF(IR,9)*XN**5
A(1)=DF
RETURN
END
END$
```

FTN4.I

SUBROUTINE TCDEF(Z)

C
C 'TCDEF' IS A SUBPROGRAM THAT CONTAINS ALL TC CURVE EQUATION CO-
C EFFICIENTS AND STORES THEM IN AN ARRAY CALLED 'TCF' WHICH IS
C IN COMMON.

C
C ALL EQUATIONS WERE DERIVED FROM N.B.S. CURVES, WHERE THE INDE-
C PENDENT VARIABLE (MILLIVOLTS) WAS NORMALIZED BETWEEN -1 AND +1.

C
C REFERENCE JUNCTION = 32 DEG-F.

C
C CALLING PROGRAM: Y6028

C
C PAUL T. PURFURA - 09/14/82

C

COMMON XIN(30),A(2),K(2),TCF(11,9),IFL

TCF(1,1)=6.0920*10.**(-2)

TCF(1,2)=29.4811*10.**(-2)

TCF(1,3)=-7.9599*10.**(-1)

TCF(1,4)=15.1489*10.**(-1)

TCF(1,5)=14.7235*10.**(-1)

TCF(1,6)=-14.4194*10.**(-1)

TCF(1,7)=27.6855*10.**(-1)

TCF(1,8)=0.

TCF(1,9)=0.

TCF(2,1)=16.3490*10.**(-2)

TCF(2,2)=19.4989*10.**(-2)

TCF(2,3)=-21.8787*10.**(-1)

TCF(2,4)=52.8841*10.**(-1)

TCF(2,5)=22.5012*10.**(-1)

TCF(2,6)=-40.4444*10.**(-1)

TCF(2,7)=0.

TCF(2,8)=0.

TCF(2,9)=0.

TCF(3,1)=52.9390*10.**(-2)

TCF(3,2)=54.6597*10.**(-3)

TCF(3,3)=-18.9363*10.**(-1)

TCF(3,4)=15.3262*10.**(-2)

TCF(3,5)=80.7975*10.**(-1)

TCF(3,6)=42.3674*10.**(-2)

TCF(3,7)=16.7773*10.**(-2)

TCF(3,8)=0.

TCF(3,9)=0.

TCF(4,1)=1.4780*10.**(-2)

TCF(4,2)=13.4771*10.**(-1)

TCF(4,3)=-99.1914*10.**(-2)

TCF(4,4)=23.4314*10.**(-1)

TCF(4,5)=17.7489*10.**(-1)

TCF(4,6)=-18.7673*10.**(-2)

TCF(4,7)=73.3276*10.**(-1)

TCF(4,8)=0.

TCF(4,9)=0.

TCF(5,1)=6.9130*10.**(0)
 TCF(5,2)=36.7985*10.**(-2)
 TCF(5,3)=-15.4338*10.**(-1)
 TCF(5,4)=92.5658*10.**(1)
 TCF(5,5)=49.4519*10.**(1)
 TCF(5,6)=-24.9707*10.**(0)
 TCF(5,7)=53.3789*10.**(-1)
 TCF(5,8)=0.
 TCF(5,9)=0.
 TCF(6,1)=18.6120*10.**(0)
 TCF(6,2)=17.0955*10.**(-2)
 TCF(6,3)=-21.8181*10.**(-1)
 TCF(6,4)=23.1347*10.**(2)
 TCF(6,5)=86.9542*10.**(1)
 TCF(6,6)=-14.0391*10.**(0)
 TCF(6,7)=30.3267*10.**(0)
 TCF(6,8)=0.
 TCF(6,9)=0.
 TCF(7,1)=27.4339*10.**(-3)
 TCF(7,2)=683.6671*10.**(-1)
 TCF(7,3)=-885.0557*10.**(-3)
 TCF(7,4)=163.3668*10.**(0)
 TCF(7,5)=404.1203*10.**(-1)
 TCF(7,6)=-192.8691*10.**(-1)
 TCF(7,7)=152.4649*10.**(-1)
 TCF(7,8)=0.
 TCF(7,9)=0.
 TCF(8,1)=479.1847*10.**(-3)
 TCF(8,2)=438.4414*10.**(-2)
 TCF(8,3)=-110.0994*10.**(-2)
 TCF(8,4)=455.2585*10.**(0)
 TCF(8,5)=164.9036*10.**(0)
 TCF(8,6)=-561.0958*10.**(-1)
 TCF(8,7)=391.1915*10.**(-1)
 TCF(8,8)=0.
 TCF(8,9)=0.
 TCF(9,1)=310.3278*10.**(-2)
 TCF(9,2)=742.7122*10.**(-3)
 TCF(9,3)=-130.4843*10.**(-2)
 TCF(9,4)=110.4443*10.**(1)
 TCF(9,5)=40.5648*10.**(1)
 TCF(9,6)=-911.3308*10.**(-1)
 TCF(9,7)=435.5711*10.**(-1)
 TCF(9,8)=0.
 TCF(9,9)=0.
 TCF(10,1)=137.6271*10.**(-1)
 TCF(10,2)=182.0053*10.**(-3)
 TCF(10,3)=-150.4887*10.**(-2)
 TCF(10,4)=244.3852*10.**(1)
 TCF(10,5)=891.8105*10.**(0)
 TCF(10,6)=-101.6005*10.**(0)
 TCF(10,7)=677.5431*10.**(-1)
 TCF(10,8)=0.
 TCF(10,9)=0.

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TCF(11,1)=17.4160*10.**(0)
TCF(11,2)=1105.5832*10.**(-4)
TCF(11,3)=-925.4837*10.**(-3)
TCF(11,4)=3606.8799*10.**(-1)
TCF(11,5)=31215.7227*10.**(-2)
TCF(11,6)=-299.8243*10.**(-1)
TCF(11,7)=1035.7422*10.**(-2)
TCF(11,8)=-569.6789*10.**(-2)
TCF(11,9)=2505.8594*10.**(-3)
RETURN
END
END\$

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FTN491

C

C 'TRFM' IS A SUBPROGRAM THAT EVALUATES THE TRANSFER FUNCTION BE-
C TWEEN THE THERMOCOUPLE WIRE AND THE GAS STREAM. IT OUTPUTS
C GAIN AND PHASE INTO THE ARRAY 'A' WHICH IS IN COMMON.

C

C THIS SUBPROGRAM CALLS THE SUBPROGRAM 'SPCY' WHICH DETERMINES
C THE SAMPLING FREQUENCY AS A FUNCTION OF THE ANALYSIS FRE-
C QUENCY.

C

C CALLING PROGRAM: Y 6024

C

C PAUL T. PURPURA - 09/14/82

C

```
SUBROUTINE TRFM(X,Y)
  DIMENSION Z(10),ZP(10)
  COMMON XIN(30),A(2),K(2),C(45),TC(4),GS(10),TP(10)
  COMMON FRQ
  CALL SPCY(X)
  XN2=A(1)
  N2=XN2
  LAF=0
  P1=0.
  P2=0.
  P3=0.
  ZC1=0.
  ZC2=0.
  PKPOS=0.
  PRNEG=0.
  DO 10 IZ=1,10
    Z(IZ)=0.
    ZP(IZ)=0.
10  CONTINUE
    Y=0.
    DELTAT=TP(2)
    CN=TP(4)
    A1=TP(5)
    B=TP(6)
    C=TP(7)
    E=TP(8)
    F=TP(9)
    G=TP(10)
    DO 70 IC=1,32000
      I1=Z(1)
      I2=Z(2)
      I3=Z(3)
      I4=Z(4)
      I5=Z(5)
      I6=Z(6)
      I7=Z(7)
      I8=Z(8)
      I9=Z(9)
      I0=Z(10)
      IR=SIN(CN*Y)
```

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$ZP(1) = (.5) * (C * (T0 + T2 - 2 * T1)) / (A1) + T1$
 $ZP(2) = (.5) * (C * (T1 + T3 - 2 * T2)) / (A1) + T2$
 $ZP(3) = (.5) * (C * (T2 + T4 - 2 * T3) + F * (TR - T3)) / (A1) + T3$
 $ZP(4) = (.5) * (C * (T3 + T5 - 2 * T4) + (2 * F) * (TR - T4)) / (A1) + T4$
 $ZP(5) = (.5) * (C * (T4 + T6 - 2 * T5) + (2 * F) * (TR - T5)) / (A1) + T5$
 $ZP(6) = (C * (T5 - T6) + E * (T7 - T6) + (F + G) * (TR - T6)) / (A1 + B) + T6$
 $ZP(7) = (.5) * (E * (T6 + T8 - 2 * T7) + (2 * G) * (TR - T6)) / (B) + T7$
 $ZP(8) = (.5) * (E * (T7 + T9 - 2 * T8) + (2 * G) * (TR - T8)) / (B) + T8$
 $ZP(9) = (E * (T8 - T9) + G * (TR - T9)) / (B) + T9$

P1=P2

P2=Z(9)

P3=ZP(9)

T=T+DELTAT

LAP=LAP+1

IF(N2-LAP)21,21,22

T=0.

LAP=0

DO 30 IP=1,9

Z(IP)=ZP(IP)

CONTINUE

IF(F2)31,31,33

IF(P3)33,32,32

ZC1=P2

ZC2=P3

XIC=IC

XIC=XIC-2.

IF(ABS(P1)-ABS(P2))34,34,70

IF(ABS(P2)-ABS(P3))70,40,40

IF(P2)41,42,42

PKNEG=P2

GO TO 43

PKPOS=P2

PKDIF=PKPOS-ABS(PKNEG)

PKQT=PKDIF/ABS(PKNEG)

IF(.001-PKQT)65,65,75

IF(XIC-200.*XN2)70,66,66

PKPOS=(PKPOS-PKNEG)/2.

GO TO 75

CONTINUE

A(1)=PKPOS

XNC=XIC/XN2

NC=XNC

YNC=NC

CHR=YNC*XN2

FRC=XIC-CHR

FRC=FRC-ZC1/(ZC2-ZC1)

FHSLAG=(FRC/XN2)*(-360.)

A(2)=FHSLAG

RETURN

END

FNDS

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FTN4,L

SUBROUTINE TRFP(X)

C
C 'TRFP' CALCULATES THE FOLLOWING PARAMETERS REQUIRED BY THE
C TRANSFER FUNCTION PROGRAM 'TRFM' AND PLACES THEM INTO AN
C ARRAY CALLED 'TP' WHICH IS PASSED THROUGH COMMON.
C
C 1. DELTA
C 2. DELTAT
C 3. SIGMA
C 4. CN
C 5. A1
C 6. R
C 7. C
C 8. E
C 9. F
C 10. G
C
C REFERENCE "DYNAMIC GAS TEMPERATURE MEASURING SYSTEM - SYSTEM
C DESIGN AND TEST PLAN (FR-16381)" FOR DEFINITION OF ABOVE TERMS.
C
C THIS SUBPROGRAM CALLS ANOTHER SUBPROGRAM (SPCY) WHICH DETERMINES
C THE SAMPLING FREQUENCY AS A FUNCTION OF THE ANALYSIS FREQUENCY.
C
C CALLING PROGRAM: 1 6024
C
C PAUL I. PURPURA - 07/20/82
C

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COMMON XIN(30),A(2),K(2),C(45),TC(4),GS(10),TP(10)
COMMON FRQ
DO 10 IZ=1,10
TP(IZ)=0.
10 CONTINUE
CALL SPCY(X)
XN2=A(1)
DELTA=XIN(4)/3.
DELTAT=1./(XN2*FRQ)
SIGMA=XIN(5)/3.
CN=2.*3.1415*FRQ
A1=(XIN(6)**2*DELTA)/(8.*TC(4)*DELTAT)
R=(XIN(7)**2*SIGMA)/(8.*TC(4)*DELTAT)
C=(XIN(6)**2)/(4.*DELTA)
E=(XIN(7)**2)/(4.*SIGMA)
F=(A(2)*SQRT(XIN(6))*DELTA)/(2.*TC(4))
G=(A(2)*SQRT(XIN(7))*SIGMA)/(2.*TC(4))
TP(1)=DELTA
TP(2)=DELTAT
TP(3)=SIGMA
TP(4)=CN
TP(5)=A1
TP(6)=R
TP(7)=C
TP(8)=E
TP(9)=F
TP(10)=G
RETURN
END
END#

SUBROUTINE XINT2(X,IX,NP)

C
C 'XINT2' IS A SUBROUTINE THAT INTEGRARIZES ANY FLOATING POINT
C NUMBER TO AN INTEGRAR AND POWER OF 10. USE OF THIS SUBPRO-
C GRAM ALONG WITH SYSTEM KEYBOARD SUBPROGRAMS PERMITS OUTPUT
C TO THE TERMINAL WITHOUT USING THE FORTRAN FORMATTER, WHICH
C SAVES ABOUT 4000 WORDS OF PROGRAM MEMORY.
C
C IT MAY BE CALLED FROM ANY FORTRAN PROGRAM BY THE FOLLOWING
C SEQUENCE:
C
C CALL XINT2(X,IX,NP)
C
C THIS PROGRAM COMMUNICATES TO THE MAIN PROGRAM VIA 2 ARRAYS.
C THESE ARE A(1) AND K(2).
C
C IT IS ALSO 'SMART' IN THAT IT WILL ROUND UP 1 DIGIT ON THE LAST
C ITERATION WHEN THE NUMBER BEING INTEGRARIZED IS .5 OR GREATER.
C
C NOTE! THE COMMON AREA OF THIS SUBPROGRAM WILL VARY FROM ONE
C SOURCE LISTING TO ANOTHER, HOWEVER, THE GENERAL SOFTWARE
C WILL ALWAYS REMAIN UNCHANGED.
C
C CALLING PROGRAMS: Y 6024, Y 6028, IRFM
C
C PAUL T. PURPURA 4/6/82.
C HAPPY EASTER!

```

COMMON XIN(30),C(45),TC(4),BS(10),TF(10),A(2),K(2)
COMMON FRG
N=0
NP=0
K(1)=0
K(2)=0
N=ABS(A(1))
501 IF(X-32000.) 510,502,502
502 X=X/10.
NP=NP+1
GO TO 501
510 IF(X-3200.) 520,520,530
520 IX=X
TX=IX
TIX=IX
IF(TX-TIX) 530,530,540
540 X=X*10.
NP=NP-1
K(2)=NP
GO TO 510
530 IX=X
TIX=IX
IX-TIX=X-TIX
IF(.5-IX-TIX) 570,600,600
570 IX=IX+1
580 IF(A(1)) 601,602,602
590 IX=-IX
600 K(1)=IX
RETURN
END
END#

```

1.4 System Subroutines

ORIGINAL PAGE IS
OF POOR QUALITY

NAME	DEFINITION
GET(N1,N2,X1,X2)	Accesses scaled data from block 'N1', channel 'N2' and stores it in 'X1' and 'X2' (real and imaginary)
PUT(N1,N2,X1,X2)	Places scaled data from 'X1' and 'X2' and stores it into block 'N2' channel 'N2' (real and imaginary)
PUTQ(N1,MQUAL)	Puts block qualifiers specified by the array 'MQUAL' into data block 'N1'
WHAT	Error flag

SUBROUTINE	KYB'D EQUIVALENT	DEFINITION
KYBD(041123B,N1)	BS N1	SET THE SYSTEM BLOCKSIZE TO 'N1'
KYBD(041514B,N1)	CL N1	CLEAR BLOCK NO. 'N1'
KYBD(042024B,N1)	D N1	DISPLAY BLOCK NO. 'N1'
KYBD(046523B,31,N1)	MS 31 N1	SET THE DISC FILE POINTER TO FILE 1, RECORD NO. 'N1'
KYBD(046523B,11,N1)	MS 11 N1	READ NEXT RECORD IN FILE 1 INTO BLOCK NO. 'N1'
KYBD(046523B,21,N1)	MS 21 N1	WRITE BLOCK NO. 'N1' INTO NEXT RECORD IN FILE 1
KYBD(054440B,1800,N1,N2)	Y 1800 N1 N2	SET VARIABLE PARA- METER 'N1' TO 'N2'
KYBD(054440B,1809,N1,N2)	Y 1809 N1 N2	PRINT THE VALUE OF VARIABLE PARAMETER 'N1' THRU 'N2'
KYBD(054440B,1822,N1,N2,N3)	Y 1822 N1 N2 N3	KEYBOARD VERSION OF 'PUT'
KYBD(054440B,5838,N1)	Y 5838 N1	READ DISC TEXT BUF- FER NO. 'N1' INTO CORE
KYBD(054440B,5819,N1)	Y 5819 N1 1	WRITE TEXT BUFFER MESSAGE NO. 'N1' ON THE TERMINAL

1.6 Text Buffers - A listing of all applicable text buffers follows this page.

**ORIGINAL PAGE IS
OF POOR QUALITY.**

Y 5803 1

WARNING -- CLEAR NEW DISC BUFFERS

/L%

490%

4to program soft keys%

4f1=graphics %

4f2=alpha%

4f3=set page full busy %

4f4=clear page full busy %

4f8=make copy%

4f&f1a1k6L%*dcfs %

4f&f1a2k6L%*ddet %

4f&f1a3k5L%*t1c%

4f&f1a4k5L%*t0c%

4f&f1a8k2L% %

4/*%

401%

4

%

4/*%

411%

4MEASURED VALUE OF GAMMA [(FT**3/2)/SEC]:%

4 <mntssa> <pwr 10> %

4/*%

404%

7/10/70

THEORETICAL VALUE OF GAMMA [(FT**3/2)/SEC]: %

<mntssa> <pwr 10> %

%

407%

LINEARIZATION IS NOW OCCURRING

ON THE FOLLOWING DATA RECORDS:

%

408%

BAD DATA AT BELOW FREQ. %

DATA POINT DISCARDED. %

<freq> <pwr 10> %

%

410%

THE MEASURED TRANSFER FUNCTION CURVE DID NOT CROSS ANY

THEORETICAL TRANSFER FUNCTION CURVE BETWEEN .5 AND 1.5%

GAMMA, OR HAD BAD COHERENCE. A MEASURED VALUE OF GAMMA

WAS NOT OBTAINED. CHECK YOUR DATA, CORRECT THE PROBLEMS

AND TRY AGAIN! %

%

%

ORIGINAL PAGE IS
OF POOR QUALITY

Y 5803 8

WARNING -- CLEAR NEW DISC BUFFERS

/L%

490%

4PRINT PARAMETER VALUES? %

4"YES" FOR ALL, LINE # FOR SINGLES

4/*%

492%

4 %

4ENTER LINE # TO EDIT, 0 TO STOP%

4/*%

493%

4 %

4LINE NUMBER?%

4/*%

494%

4 %

4PRINT THE REST OF THE PARAMETERS? %

4/*%

4_

ORIGINAL PAGE IS
OF POOR QUALITY

Y 5803 9

WARNING -- CLEAR NEW DISC BUFFERS

/L%

497%

4INVALID INPUT %

4/*%

464%

4SETUP NO.? (1-100)\ %

4/*%

474%

4RECALL%

4/*%

475%

4SAVE INTO %

4/*%

4_

ORIGINAL PAGE IS
OF POOR QUALITY

Y 5803 10

WARNING -- CLEAR NEW DISC BUFFERS

/L%

401%

4

4/*%

408%

4

4ALL DONE!0%

4/*%

403%

44*ddet%

4ALPHA-NUMERIC DISPLAY%

4/*%

410%

44*dcfs%

4GGRAPHICS DISPLAY %

4/*%

406%

4SYSTEM IS EVALUATING TRANSFER FUNCTION. THE 2 VALUES SCRD- %
4LING UP THE SCREEN ARE THE INSTANTANEOUS FREQUENCY AND GAM- %
4MA INDEX. THE GAMMA INDEX IS NOT DISPLAYED WHEN THE SYSTEM%
4IS EVALUATING THE TRANSFER FUNCTION FOR A MEASURED VALUE OF %
4GAMMA.%

4 <number> <pwr 10>%

4/0%

402%

4SYSTEM IS READY TO ACQUIRE DATA.%

4 %

4PRESS "CONTINUE" TO START DATA ACQUISITION.0%

4/0%

411%

4END OF DATA ACQUISITION0. %

4/0%

4

Y 5803 50

WARNING -- CLEAR NEW DISC BUFFERS

/L%

401%

4(RMS DEG-F) %

4/*%

402%

4(RMS DEG-F)/SQRT-HZ %

4/*%

403%

4(MEAN-SQR DEG-F)/HZ %

4/*%

404%

4(MEAN-SQR DEG-F)/HZ - dB%

4/*%

405%

4(DEG-F) %

4/*%

406%

4THE PLOT CODE PRESENTLY ENTERED IS ILLEGAL! %

4 %

4PLEASE CORRECT THIS CONDITION BY ENTERING %

4A LEGAL PLOT CODE FOR EDIT NO. 40.%

4 %

ORIGINAL PAGE 18
OF POOR QUALITY

4THANK YOU!4 %

4/0%

429%

4 %

429 LARGE OR SMALL WIRE T/C? %

4 (0=SMALL, 1=LARGE)\%

4/0%

430%

4 %

430 EVALUATE (LARGE WIRE/SMALL WIRE) %

4 T/C H(f)? (0=NO, 1=YES)\ %

4/0%

4

Y 5803 51

WARNING -- CLEAR NEW DISC BUFFERS

/L%

411%

4 %

411 T/C CODE (0=Pt/6%Rh, 1=Pt/30%Rh)?%

4 CODE:\ %

4/+%

414%

4 %

414 DIAMETER OF SUPPORT WIRE (INCHES)? %

4 < dmtr > <pwr 10>%

4\ %

4/+%

422%

4 %

422 MEAN GAS PRESSURE (PSIA)?%

4 < pres > <pwr 10>%

4\ %

4/+%

423%

4 %

423 MACH NUMBER? %

4_ < numb > <pwr 10>%

4\ 6

4/+6

4506

4/ 6

4/+6

4136

4 6

413 LENGTH OF SMALLER WIRE (INCHES/2)? 6

4 <length> <pwr 10>6

4\ 6

4/+6

4156

4 6

415 DIAMETER OF SMALLER WIRE (INCHES)? 6

4 < dmr > <pwr 10>6

4\ 6

4/+6

4126

4 6

412 LENGTH OF SUPPORT WIRE (INCHES)? 6

4 <length> <pwr 10>6

4\ 6

4/+6

4216

4 6
421 MEAN GAS TEMPERATURE (DEG-F)? 6

4 < temp > < pwr 10 > 6

4\ 6

4/ 6

428 6

4 6
428 FREQUENCY INCREMENT? 6

4 < incr > < pwr 10 > 6

4\ 6

4/ 6

424 6

424 FUEL TO AIR RATIO (F/A)? 6

4 < rtio > < pwr 10 > 6

4\ 6

4/ 6

499 6

4 DYNAMIC TEMPERATURE MEASUREMENT - 6

4 THEORETICAL H(f) CRITERIA 6

4 6

4/ 6

425 6

425 THEORETICAL DELTA-F SETTING? 6

4 < sttg > < pwr 10 > 6

ORIGINAL PAGE IS
OF POOR QUALITY

41 6

4/26

4276

4 6

427 ENDING FREQUENCY?6

4 < freq > < pwr 10 > 6

41 6

4/26

4266

4 6

426 STARTING FREQUENCY?6

4 < freq > < pwr 10 > 6

41 6

4/26

4

Y 5803 52

WARNING -- CLEAR NEW DISC BUFFERS

/L%

410%

4 %

410 CHANNEL "A" AMPLIFIER GAIN?%

4 < gain > < pwr 10 > %

4\ %

4/ %

411%

4 %

411 CHANNEL "A" RECORD LEVEL?%

4 < lev1 > < pwr 10 > %

4\ %

4/ %

412%

4 %

412 CHANNEL "A" DC OFFSET? %

4 < offset > < pwr 10 > %

4\ %

4/ %

420%

4 %

420 CHANNEL "B" AMPLIFIER GAIN?%

ORIGINAL PAGE IS
OF POOR QUALITY

4 < gain > < pwr 10 >

4\

4/*

421

4

421 CHANNEL "B" RECORD LEVEL?

4 < lev1 > < pwr 10 >

4\

4/*

422

4

422 CHANNEL "B" DC OFFSET?

4 < offset > < pwr 10 >

4\

4/*

430

4

430 CHANNEL "C" AMPLIFIER GAIN?

4 < gain > < pwr 10 >

4\

4/*

431

4

431 CHANNEL "C" RECORD LEVEL?

ORIGINAL PAGE 13
OF POOR QUALITY

4 < lev1 > < pwr 10 > %

4 \ %

4 / %

4 32 %

4 %

4 32 CHANNEL "C" DC OFFSET? %

4 < offset > < pwr 10 > %

4 \ %

4 / %

4 05 %

4 %

4 05 ADC DELTA-F SETTING? %

4 < sttg > < pwr 10 > %

4 \ %

4 / %

4 99 %

4 DYNAMIC TEMPERATURE MEASUREMENT - %

4 MEASURED H(f) CRITERIA %

4 %

4 / %

4 06 %

4 %

4 06 NUMBER OF THRU-PUT RECORDS %

4 DESIRED? \ %

ORIGINAL PAGE IS
OF POOR QUALITY

4/06

407

4 6

407 NUMBER OF POWER SPECTRUM AV- 6

4 ERAGES DESIRED?\ 6

4/06

409

4 6

409 NEW "GAMMA" AND COMP. SPECTRUM? 6

4 (0=NO, 1=YES)\ 6

4/06

408

4 6

408 STARTING RECORD NUMBER? (70,73,76

4 ETC.)\ 6

4/06

4

Y 5803 53

WARNING -- CLEAR NEW DISC BUFFERS

/L%

410%

4 %

410 PLOT UNCOMPENSATED OR COMPENSATED%

4 DATA? (0=UNCOMP, 1=COMP)\%

4/%

420%

4 %

420 PLOT AVERAGED OR INSTANTANEOUS %

4 DATA? (0=AVG, 1=INST)\ %

4/%

421%

4*****%

4* IF DATA IS INSTANTANEOUS:%

4* %

4* 21 STARTING RECORD NO.?\ %

4/%

422%

4* %

4* 22 NO. OF RECORDS?\%

4/%

430%

4 6
430 PLOT FULL OR PARTIAL TIME RANGE? 6
4 (0=FULL, 1=PARTIAL)\ 6
4/ 6
4996
4DYNAMIC TEMPERATURE MEASUREMENT - 6
4PROCESSING AND PLOTTING CRITERIA6
4 6
4/ 6
4246
4 6
4 24 NO. OF "SMOOTHs" TO PERFORM ON6
4 TIME DATA?\ 6
4/ 6
4256
4 6
4 25 PLOT TIME & FREQ DATA? (0=TIME6
4 ONLY, 1=TIME & FREQ)\ 6
4/ 6
4316
4*****6
4 IF A PARTIAL RANGE IS DESIRED: 6
4 6
4 31 STARTING TIME?6

ORIGINAL PAGE IS
OF POOR QUALITY

4+ < time > < pwr 10 > %
4+ \ %
4+ %
432 %
4+ %
4+ 32 ENDING TIME? %
4+ < time > < pwr 10 > %
4+ \ %
4+ %
423 %
4+ %
4+ 23 THRESHOLD TO CLEAR ON FREQ DA- %
4+ TA IN "dB"? \ %
4+ %
426 %
4+ %
4+ IF DATA IS AVERAGED: %
4+ %
4+ 26 PLOT LARGE OR SMALL WIRE DATA? %
4+ (0=SMALL, 1=LARGE) \ %
4+ %
4+

Y 5803 54

WARNING -- CLEAR NEW DISC BUFFERS

/L%

409%

4

%

409 NEW GAMMA AND NEW COMP. SPEC.? %

4 (0=NO, 1=YES)\ %

4/*%

413%

4

%

413 OLD GAMMA BUT NEW COMP. SPEC.? %

4 (0=NO, 1=YES)\ %

4/*%

414%

4

%

414 GAMMA VALUE: %

4 < valu > <pwr 10>%

4\ %

4/*%

429%

4

%

429 EVALUATE 10mil/3mil H(f)? (0=NO%

4 1=YES)\%

4/*%

435%

4 %

435 PLOT FULL OR PARTIAL FREQ RANGE? %

4 (0=FULL, 1=PARTIAL)\ %

4/%

440%

4 %

440 ENTER PLOT CODE PER BELOW. (FREQ %

4 DATA ONLY)\ %

4/%

441%

4 %

4 1=(RMS DEG-F)%

4 2=(RMS DEG-F)/SQRT-HZ%

4 3=(MEAN-SQR DEG-F)/HZ%

4 4=(MEAN-SQR DEG-F)/HZ - dB %

4/%

436%

4*****%

4* IF A PARTIAL RANGE IS DESIRED: %

4* %

4* 36 STARTING FREQ?%

4* < freq > < pwr 10 > %

4* \%

ORIGINAL PAGE IS
OF POOR QUALITY

4/0%

437%

40 %

40 37 ENDING FREQ?%

40 < freq > < pwr 10 > %

40 1%

4/0%

4

2.1 Keyboard Program End Codes

JBUF(1)	User end code 'N1'
JBUF(2)	User end code 'N2'
JBUF(3)	User end code 'N3'
JBUF(4)	User end code 'N4'
JBUF(5)	User end code 'N5'
JBUF(6)	User end code 'N6'

2.2 Data Block Qualifiers

HQUAL(1)	Data block blocksize
HQUAL(2)	Data block coordinate code
HQUAL(3)	Data block calibrator
HQUAL(4)	Data block frequency code
HQUAL(5)	Data block status

2.3 T/C Wire & Gas Stream Equation Coefficients

ARRAY	DEFINITION
C(1)	
V	
C(45)	

2.4 N.R.S Temperature Equation Coefficients

TCF(1,1)	
V	
TCF(11,9)	

XIN(1)	Edit No. 11 - Thermocouple code
XIN(2)	Edit No. 29 - Large or small wire TC flag
XIN(3)	Edit No. 24 - Fuel to air ratio
XIN(4)	Edit No. 12 - Length of support wire
XIN(5)	Edit NO. 13 - Length of smaller wire
XIN(6)	Edit No. 14 - Diameter of support wire
XIN(7)	Edit No. 15 - Diameter of smaller wire
XIN(8)	Edit No. 21 - Mean gas temperature
XIN(9)	Edit No. 22 - Mean gas pressure
XIN(10)	Edit No. 23 - Mach number
XIN(11)	Edit No. 25 - ADC delta-F settings (theoretical)
XIN(12)	Edit No. 26 - Starting frequency
XIN(13)	Edit No. 27 - Frequency increment
XIN(14)	Edit No. 05 - ADC Delta-F settings (measured)
XIN(15)	Edit No. 10 - CH: A amplifier gain
XIN(16)	Edit No. 11 - CH: A record level
XIN(17)	Edit No. 12 - CH: A DC offset
XIN(18)	Edit No. 20 - CH: B amplifier gain
XIN(19)	Edit No. 21 - CH: B record level
XIN(20)	Edit No. 22 - CH: B DC offset
XIN(21)	Edit No. 30 - CH: C amplifier gain
XIN(22)	Edit No. 31 - CH: C record level
XIN(23)	Edit No. 32 - CH: C DC offset
XIN(24)	Edit No. 14 - Gamma value
XIN(25)	Edit No. 28 - Ending frequency
XIN(26)	Not used
XIN(27)	Not used
XIN(28)	Not used
XIN(29)	Not used
XIN(30)	Not used

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NOTE: Edits referenced from XIN(14) to XIN(24) apply to measured H(f) criteria. All other edits referenced apply to theoretical H(f) criteria.

10/10/76
10/10/76

2.6 Thermocouple Wire Parameters

TC(1)	T/C wire density (ρ)
TC(2)	T/C Thermal conductivity (k)
TC(3)	Specific heat (CP)
TC(4)	Thermal diffusivity (δ)

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OF FOUR QUALITY	
GS(1)	Gas stream density (Rho)
GS(2)	Gas stream thermal conductivity (K)
GS(3)	Gas stream specific heat (Cp)
GS(4)	Specific heat ratio (Y)
GS(5)	Viscosity (Mu)
GS(6)	Sonic Velocity (c)
GS(7)	Kinetic viscosity [SQRT.(G)]
GS(8)	Prandtl number (PR)
GS(9)	Mean gas velocity (U)
GS(10)	Aerodynamic parameter (Gamma)

ITP(1)	H(f) coefficient (DELTA)
ITP(2)	H(f) coefficient (Delta T)
ITP(3)	H(f) coefficient (delta)
ITP(4)	H(f) coefficient (Cn)
ITP(5)	H(f) coefficient (A)
ITP(6)	H(f) coefficient (B)
ITP(7)	H(f) coefficient (C)
ITP(8)	H(f) coefficient (E)
ITP(9)	H(f) coefficient (F)
ITP(10)	H(f) coefficient (G)

2.9 Finite Element Coefficients

ARRAY	DEFINITION
Z(1)	H(f) coefficient (Z1)
Z(2)	H(f) coefficient (Z2)
Z(3)	H(f) coefficient (Z3)
Z(4)	H(f) coefficient (Z4)
Z(5)	H(f) coefficient (Z5)
Z(6)	H(f) coefficient (Z6)
Z(7)	H(f) coefficient (Z7)
Z(8)	H(f) coefficient (Z8)
Z(9)	H(f) coefficient (Z9)
Z(10)	H(f) coefficient (Z0)

2.10 Finite Element Solutions

ZF(1)	H(f) Node 1 Finite Element Solution (ZF1)
ZF(2)	H(f) Node 2 Finite Element Solution (ZF2)
ZF(3)	H(f) Node 3 Finite Element Solution (ZF3)
ZF(4)	H(f) Node 4 Finite Element Solution (ZF4)
ZF(5)	H(f) Node 5 Finite Element Solution (ZF5)
ZF(6)	H(f) Node 6 Finite Element Solution (ZF6)
ZF(7)	H(f) Node 7 Finite Element Solution (ZF7)
ZF(8)	H(f) Node 8 Finite Element Solution (ZF8)
ZF(9)	H(f) Node 9 Finite Element Solution (ZF9)
ZF(10)	H(F) Node 0 Finite Element Solution (ZF0)

2.11 Scratch Arrays

ARRAY	DEFINITION
A(1)	Pass intermediate data through COMMON
A(2)	
K(1)	
K(2)	

3.0 DATA ASSIGNMENTS

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3.1 Variable Param Assignments

UP #	MODE	DESCRIPTION
100 TO 14	-	SCRATCH
115 TO 18	-	NOT USED
19	-	EDIT FLAG
20	-	EDIT BUTTON FLAG
121 TO 38	-	NOT USED
39	-	SET-UP NO.
140 TO 52	-	NOT USED
53	-	EDIT PHASE - LABEL NO.
54	-	EDIT PHASE - TEXT BUFFER NO.
55	-	EDIT PHASE - KEYBOARD NO.
156 TO 73	-	NOT USED
74	-	SCRATCH
175 TO 179	-	NOT USED
180	-	SCRATCH
1181 TO 186	-	NOT USED
187	-	SCRATCH
1188 TO 197	-	NOT USED
198	1	AUTO SEQ - QUESTION NO. 30
199	1	AUTO SEQ - QUESTION NO. 11
200	1	AUTO SEQ - QUESTION NO. 29
201	1	AUTO SEQ - QUESTION NO. 24
202	1	AUTO SEQ - QUESTION NO. 24
203	1	AUTO SEQ - QUESTION NO. 12
204	1	AUTO SEQ - QUESTION NO. 12
205	1	AUTO SEQ - QUESTION NO. 13
206	1	AUTO SEQ - QUESTION NO. 13
207	1	AUTO SEQ - QUESTION NO. 14
208	1	AUTO SEQ - QUESTION NO. 14
209	1	AUTO SEQ - QUESTION NO. 15
210	1	AUTO SEQ - QUESTION NO. 15
211	1	AUTO SEQ - QUESTION NO. 21
212	1	AUTO SEQ - QUESTION NO. 21
213	1	AUTO SEQ - QUESTION NO. 22
214	1	AUTO SEQ - QUESTION NO. 22
215	1	AUTO SEQ - QUESTION NO. 23
216	1	AUTO SEQ - QUESTION NO. 23
217	1	AUTO SEQ - QUESTION NO. 25
218	1	AUTO SEQ - QUESTION NO. 25
219	1	AUTO SEQ - QUESTION NO. 26

VF #	MODE	DESCRIPTION
220	1	AUTO SEQ - QUESTION NO. 26
221	1	AUTO SEQ - QUESTION NO. 27
222	1	AUTO SEQ - QUESTION NO. 28
223	1	TIME MAP - QUESTION NO. 05
224	1	TIME MAP - QUESTION NO. 05
225	1	TIME MAP - QUESTION NO. 10
226	1	TIME MAP - QUESTION NO. 10
227	1	TIME MAP - QUESTION NO. 11
228	1	TIME MAP - QUESTION NO. 11
229	1	TIME MAP - QUESTION NO. 12
230	1	TIME MAP - QUESTION NO. 12
231	1	TIME MAP - QUESTION NO. 20
232	1	TIME MAP - QUESTION NO. 20
233	1	TIME MAP - QUESTION NO. 21
234	1	TIME MAP - QUESTION NO. 21
235	1	TIME MAP - QUESTION NO. 22
236	1	TIME MAP - QUESTION NO. 22
237	1	TIME MAP - QUESTION NO. 30
238	1	TIME MAP - QUESTION NO. 30
239	1	TIME MAP - QUESTION NO. 31
240	1	TIME MAP - QUESTION NO. 31
241	1	TIME MAP - QUESTION NO. 32
242	1	TIME MAP - QUESTION NO. 32
243	1	TIME MAP - QUESTION NO. 14
244	1	TIME MAP - QUESTION NO. 14
245	1	AUTO SEQ - QUESTION NO. 27
246	1	AUTO SEQ - QUESTION NO. 27
247 TO 258	-	NOT USED
259	1	TIME MAP - QUESTION NO. 07
260	1	TIME MAP - QUESTION NO. 08
261	1	TIME MAP - QUESTION NO. 09
262	1	TIME MAP - QUESTION NO. 13
263	1	TIME MAP - QUESTION NO. 14
264	2	TIME MAP - QUESTION NO. 10
265	2	TIME MAP - QUESTION NO. 20
266	2	TIME MAP - QUESTION NO. 21
267	2	TIME MAP - QUESTION NO. 22
268	2	TIME MAP - QUESTION NO. 23
269	2	TIME MAP - QUESTION NO. 24

VP #	MODE	DESCRIPTION
270	2	TIME MAP - QUESTION NO. 25
271	2	TIME MAP - QUESTION NO. 30
272	2	TIME MAP - QUESTION NO. 31
273	2	TIME MAP - QUESTION NO. 31
274	2	TIME MAP - QUESTION NO. 32
275	2	TIME MAP - QUESTION NO. 32
276	2	TIME MAP - QUESTION NO. 35
277	2	TIME MAP - QUESTION NO. 36
278	2	TIME MAP - QUESTION NO. 36
279	2	TIME MAP - QUESTION NO. 37
280	2	TIME MAP - QUESTION NO. 37
281	2	TIME MAP - QUESTION NO. 40
282	2	TIME MAP - QUESTION NO. 26
283	1	TIME MAP - QUESTION NO. 06
284 TO 479	-	NOT USED
480	-	SCRATCH
2000 TO	-	SCRATCH
2008	-	
2009 TO	-	NOT USED
2029	-	
3000	-	SCRATCH
3001	-	SCRATCH
3002 TO	-	NOT USED
3014	-	

3.2 File 1 Record Assignments

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REC. NO.	ASSIGNMENT
0 TO 2	SCRATCH AREA
3	POWER SPECTRUM - SMALL WIRE T/C
4	POWER SPECTRUM - LARGE WIRE T/C
5	POWER SPECTRUM - REAL PART CROSS POWER (1)
6	POWER SPECTRUM - IMAG PART CROSS POWER (1)
7	MEASURED $H(f)$ - (LARGE WIRE)/(SMALL WIRE)
8	COHERENCE FUNCTION - $(Y**2)$
9	THEORETICAL $H(f)$ - (LARGE WIRE)/(SMALL WIRE)(2)
10 TO 29	THEORETICAL $H(f)$ - (SMALL WIRE)/(GAS STREAM)(3)
30 TO 49	THEORETICAL $H(f)$ - (LARGE WIRE)/(GAS STREAM)(3)
50 TO 69	THEORETICAL $H(f)$ - (LARGE WIRE)/(SMALL WIRE)(3)
70 TO 438	DISC THROUGHPUT - RAW TIME DOMAIN DATA

(1) - STORED AS DOUBLE PRECISION

(2) - COMPENSATION SPECTRUM

(3) - $H(f)$ CURVES GOING FROM .5 GAMMA TO 1.5 GAMMA IN INCREMENTS
OF .1 GAMMA.

4.1 T/C wire parameters - Pt/6%Rh and Pt/30%Rh respectively.

4.1.1 Density (LBS/IN**3)

$$\text{RHO} = 0.740$$

$$\text{RHO} = 0.632$$

4.1.2 Thermal conductivity (BTU/FT-SEC-DEG R)

$$\text{K(T)} = [1/3600] [3.8926\text{E}+01 + (1.8746\text{E}-03)(\text{T}) + (2.1226\text{E}-06)(\text{T}^2) - (2.7962\text{E}-10)(\text{T}^3)]$$

$$\text{K(T)} = [1/3600] [3.0239\text{E}+01 + (1.0526\text{E}-02)(\text{T}) - (1.8102\text{E}-06)(\text{T}^2) + (1.1490\text{E}-10)(\text{T}^3)]$$

4.1.3 Specific Heat (BTU/LB-DEG R)

$$\text{CP(T)} = 3.2070\text{E}-02 + (4.8648\text{E}-06)(\text{T}) - (3.8201\text{E}-13)(\text{T}^2) - (1.0204\text{E}-13)(\text{T}^3)$$

$$\text{CP(T)} = 3.9228\text{E}-02 + (4.8327\text{E}-06)(\text{T}) + (3.3457\text{E}-09)(\text{T}^2) - (1.7809\text{E}-12)(\text{T}^3) + (2.2544\text{E}-16)(\text{T}^4)$$

4.1.4 Thermal Diffusivity (FT**2/SEC)

$$\text{ALPHA(T)} = 2.6336\text{E}-04 - (2.4880\text{E}-08)(\text{T}) + (1.4592\text{E}-11)(\text{T}^2) - (1.5780\text{E}-15)(\text{T}^3)$$

$$\text{ALPHA(T)} = 1.9764\text{E}-04 + (3.2121\text{E}-08)(\text{T}) - (1.5888\text{E}-11)(\text{T}^2) + (2.9097\text{E}+03)(\text{T}^3)$$

4.2 Gas stream parameters

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4.2.1 Density (LBS/IN**3)

$$\text{RHO} = 2.6983(P/T) \quad \text{where } P = \text{PSIA}, T = \text{DEG R}$$

4.2.2 Thermal Conductivity (BTU/FT-HR-DEG R)

$$\begin{aligned} K(T) &= 1.40203\text{E-}02 + (1.89980\text{E-}05)(T) & \text{for } F/A = .01 \\ K(T) &= 1.40413\text{E-}02 + (1.94294\text{E-}05)(T) & \text{for } F/A = .02 \\ K(T) &= 1.40622\text{E-}02 + (1.98590\text{E-}05)(T) & \text{for } F/A = .03 \end{aligned}$$

4.2.3 Specific Heat (BTU/LBm-DEG R)

$$\begin{aligned} \text{CP}(T) &= 2.4733\text{E-}01 + (2.7857\text{E-}05)(T) & \text{for } F/A = .01 \\ \text{CP}(T) &= 2.4413\text{E-}01 + (2.7400\text{E-}05)(T) & \text{for } F/A = .02 \\ \text{CP}(T) &= 2.3937\text{E-}01 + (2.7091\text{E-}05)(T) & \text{for } F/A = .03 \end{aligned}$$

4.2.4 Specific Heat Ratio

$$\begin{aligned} Y(T) &= 1.3750\text{E+}00 - (-3.4000\text{E-}05)(T) & \text{for } F/A = .01 \\ Y(T) &= 1.3690\text{E+}00 - (-3.4500\text{E-}05)(T) & \text{for } F/A = .02 \\ Y(T) &= 1.3630\text{E+}00 - (-3.5000\text{E-}05)(T) & \text{for } F/A = .03 \end{aligned}$$

4.2.5 Viscosity (LB/FT-SEC)

$$\text{MU}(T) = 1.6100\text{E-}05 + (9.0260\text{E-}09)(T)$$

4.2.6 Sonic Velocity (FT/SEC)

$$C = 41.454[\text{SQRT}(Y)(T)] \quad \text{where } T = \text{DEG 12}$$

4.2.7 Kinetic Viscosity (FT**2/SEC)

$$\text{SQRT}(g) = \text{MU}/\text{RHO}$$

4.2.8 Prandtl Number

$$\text{PR} = 3600(\text{MU})(\text{CP})/K$$

4.2.9 Mean Gas Velocity (FT/SEC)

$$U = M(C)$$

4.2.10 Aerodynamic Parameter [FT**(3/2)/SEC]

$$\text{GAMMA} = [(.48)(K)[\text{SQRT}(U)][\text{PR}**(1.3)]$$

$$\text{GAMMA} = \text{GAMMA}/[(3600)(\text{RHOw})(\text{CPw})[\text{SQRT}(g)]]$$

4.3 Finite Element Solution Coefficient Algorithms

- 4.3.1 $\Delta = L/3$ o L =length of the T/C support wire
- 4.3.2 $\Delta Z = 1/(XN2)(F_n)$ o $XN2$ =the number of samples/cycle, determined by the subroutine 'SPCY'
- 4.3.3 $\delta = l/3$ o l =1/2 the length of the smaller T/C wire
- 4.3.4 $C_n = 2(\pi)(F_n)$
- 4.3.5 $A = (D^{**2})(\Delta)/(8)(\alpha)(\Delta T - t)$ o D =the diameter of the support wire
 α =the T/C wire thermal diffusivity
- 4.3.6 $B = (d^{**2})(\delta)/(8)(\alpha)(\Delta T - Z)$ o d =the diameter of the smaller wire
- 4.3.7 $C = D^{**2}/4(\Delta)$
- 4.3.8 $E = d^{**2}/4(\delta)$
- 4.3.9 $F = \text{GAMMA}(\Delta)[\text{SQRT}(D)]/2(\alpha)$
- 4.3.10 $G = \text{GAMMA}(\delta)[\text{SQRT}(d)]/2(\alpha)$
- 4.3.11 $TR = \sin[(C_n)(T)]$ o $T = T + \Delta T - L$

4.4 Finite Element Solution Algorithms

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$$4.4.1 \quad ZP0=0$$

$$4.4.2 \quad ZP1=(C/2A)(Z0+Z2-2Z1)+Z1$$

$$4.4.3 \quad ZP2=(C/2A)(Z1+Z3-2Z2)+Z2$$

$$4.4.4 \quad ZP3=(1/2A)[C(Z2+Z4-2Z3)+F(TR-Z3)]+Z3$$

$$4.4.5 \quad ZP4=(1/2A)[C(Z3+Z5-2Z4)+2F(TR-Z4)]+Z4$$

$$4.4.6 \quad ZP5=(1/2A)[C(Z4+Z6-2Z5)+2F(TR-Z5)]+Z5$$

$$4.4.7 \quad ZP6=[1/(A+B)][C(Z5-Z6)+E(Z7-Z6)+$$

$$4.4.8 \quad ZP7=(1/2B)[E(Z6+Z8-2Z7)+2G(TR-Z7)]+Z7$$

$$4.4.9 \quad ZP8=(1/2B)[E(Z7+Z9-2Z8)+2G(TR-Z8)]+Z8$$

$$4.4.10 \quad ZP9=(1/B)[E(Z8-Z7)+G(TR-Z9)]+Z9$$

***** COMMAND FILES FOR HOST PROGRAM OVERLAYS *****

***** OVERLAY # 16 *****

QE
A, DURLYN
T, SNAPC
B, 6020
B, 6021
B, 6022
B, 6023
B, 6024
B, 6027
QE

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CSORT+

F, ZY6020
Y, Y6020
F, ZY6021
Y, Y6021
F, ZY6022
Y, Y6022
F, ZY6023
Y, Y6023
F, ZY6024
Y, Y6024
F, ZY6027
Y, Y6027
F, ZTRFF
Y, YTRFF
F, ZTRFM
Y, YTRFM
F, ZBPCY
Y, YBPCY
F, ZXINTZ
Y, YXINTZ
F, N3501A
Y, YN3501A

CSORT-

F, N3500A
L, **
F, N3501A
L, **
F, A3060A
L, **
H, **
O, 01
S, **
S, **

***** OVERLAY # 17 *****

@@
H,DURLYN
T,SNAPC
P,6020
M,6028
M,6029
@E

CSORT+

F,ZY6020
Y,Y6020
F,ZY6028
Y,Y6028
F,ZY6029
Y,Y6029
F,ZTCDEF
Y,TCDEF
F,ZTCALC
Y,TCALC

ORIGINAL PAGE IS
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CSORT-

F,N3500A
L,**
F,N3501A
L,**
F,A3060A
L,**
U,**
E,01
::
\$\$

***** OVERLAY # 18 *****

DURLYN
SNAPC
A050

CSORT+

ZY6050
Y6050

CSORT-

ORIGINAL PAGE IS
OF POOR QUALITY.

N3500A
**
N3501A
**
A3060A
**
**
01

***** OVERLAY # 19 *****

@@
A,DURLYN
T,SNAPC
@,6020
@,6026
@@

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CSORT+

F,ZY6020
Y,Y6020
F,ZY6026
Y,Y6026

CSORT-

F,N3500A
L,**
F,N3501A
L,**
F,A3060A
L,**
U,**
E,01
:
\$

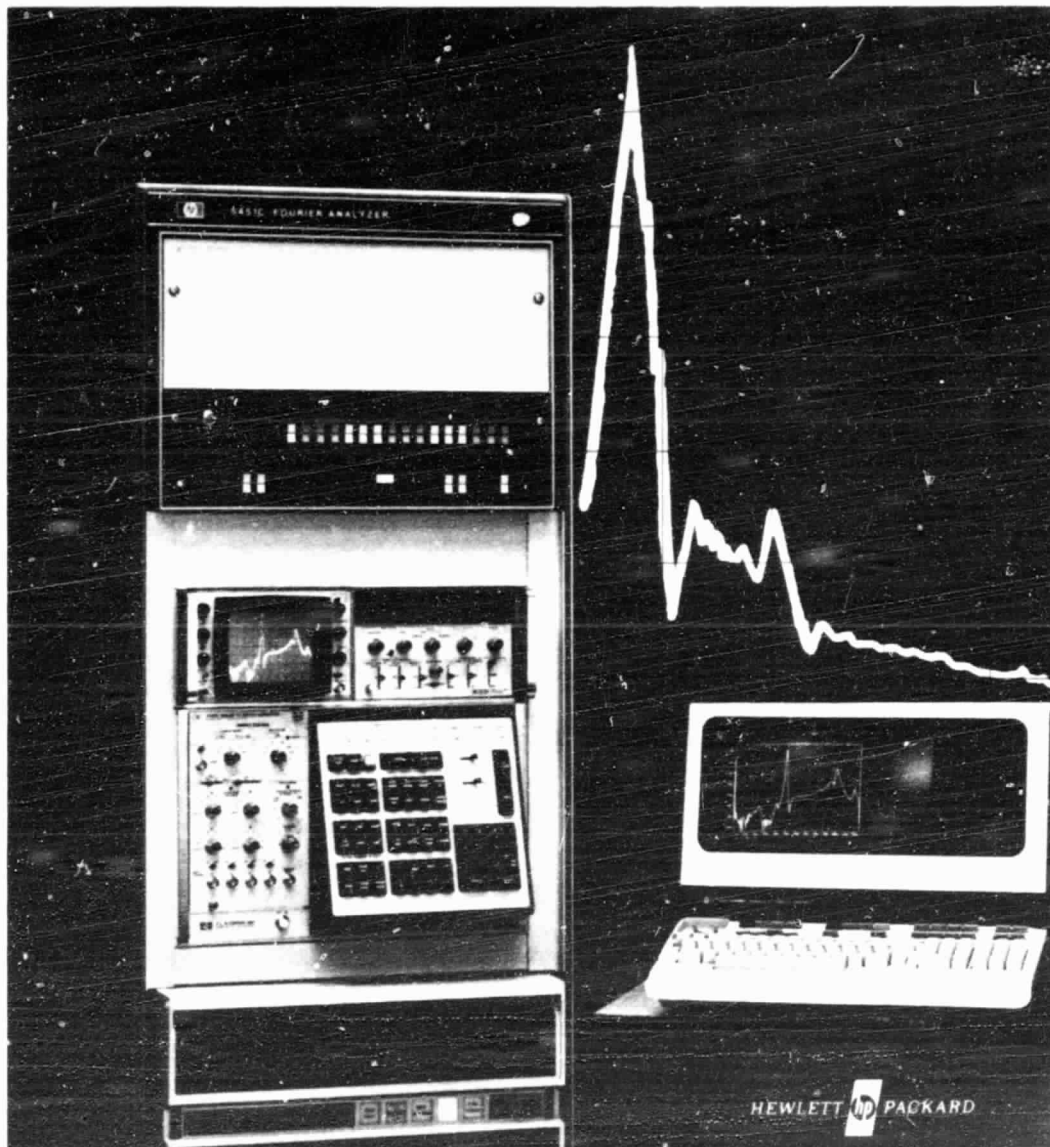
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SECTION 3 FOURIER ANALYZER SYSTEM DESCRIPTION

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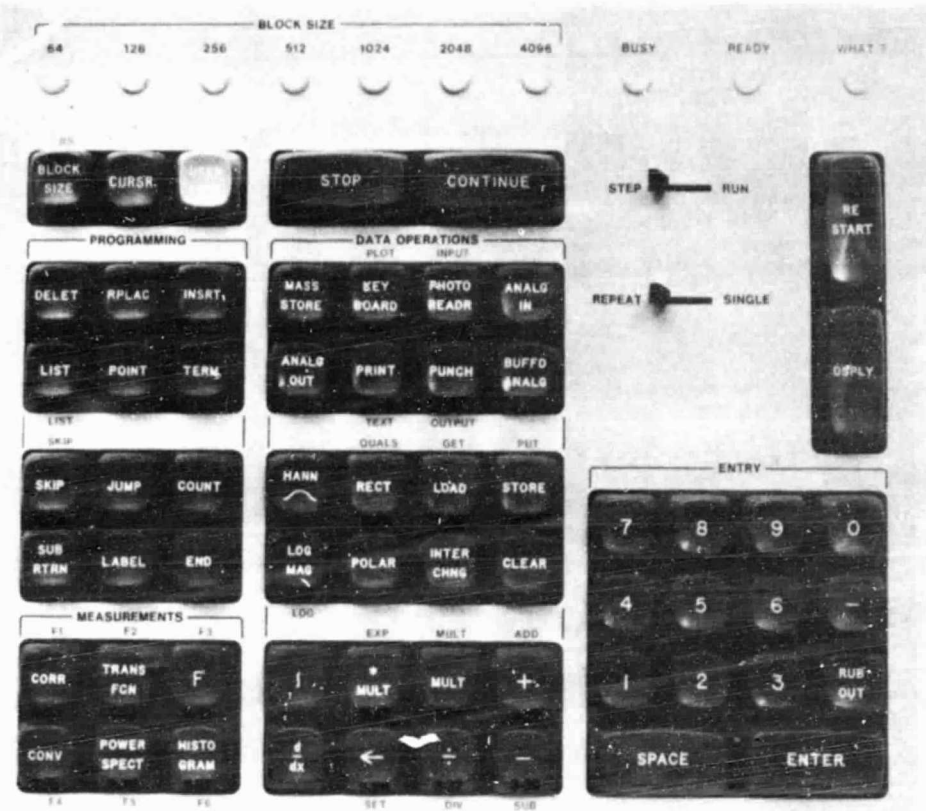
5451 POWER ANALYZER SYSTEM



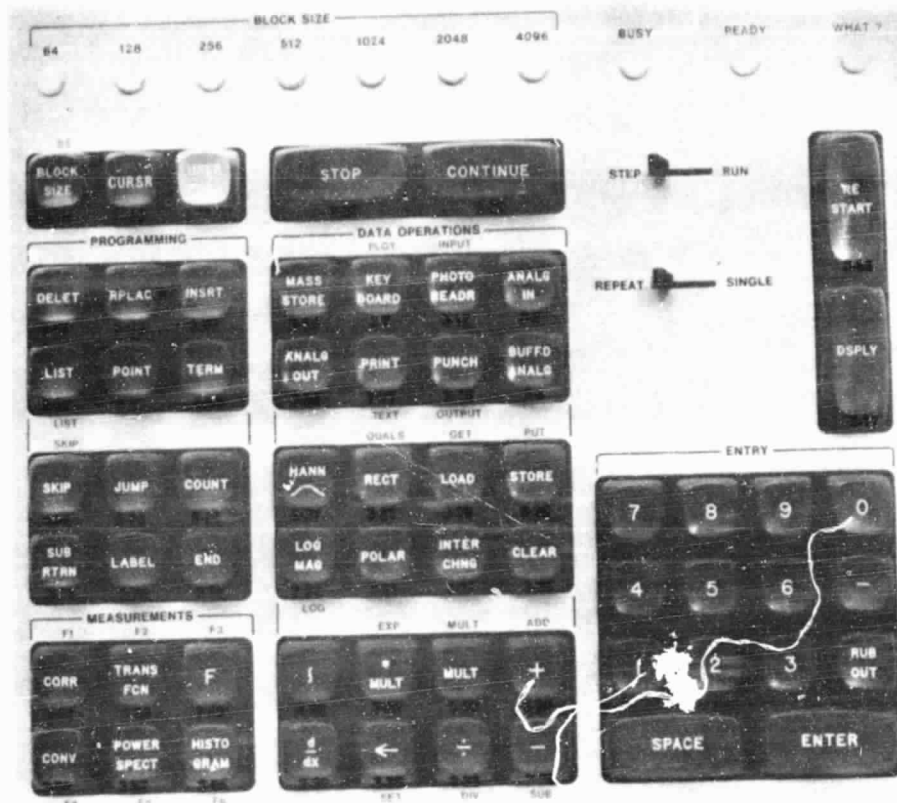
QUICK-KEY REFERENCE

GOLD KEYS

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QUICK-KEY REFERENCE STANDARD KEYS



ALPHABETICAL INDEX OF KEY DESCRIPTIONS

This appendix contains an alphabetical index of the key descriptions followed by an illustration showing the key exactly as it appears on the front panel of the 5475A Control Unit. In addition, the symbol that is printed out for each key is shown. When a key has more than one function (e.g., KEYBOARD/PLOT), each is listed separately.























Table B-1. Alphabetical Index

Function	Key	Symbol	Function	Key	Symbol
Add*		Y A+	Block Size		BS
Analog In		RA	Block Size*		Y BS
Analog Output		B	Block Subtraction		A-
Block Addition		A+	Buffered Analog		RB
Block Conjugate Multiply		*-	Clear		CL
Block Division		:	Complex Multiply		*
Block Multiply		*	Conjugate		*-
Block Shift		—	Continue		

*Variable Parameter or User Program

5451C OPERATING























Table 8-1. Alphabetical Index (cont'd)

Function	Key	Symbol	Function	Key	Symbol
Convolution		CV	F1*		Y CR
Correlation		CR	F2*		Y CH
Count		C	F3*		Y F
Cursor		/	F4*		Y CV
Delete		/D	F5*		Y SP
Differentiation		%	F6*		Y RH
Display		D	GET		Y X<
Division*	 DIV	Y :	Histogram		RH
End			INPUT		Y R
Exponentiate*	 EXP	Y *-	Insert		/I
Fourier Transform		F	Integer Divide		:

*Variable Parameter or User Program

5451C OPERATING




















Table B-1. Alphabetical Index (cont'd)

Function	Key	Symbol	Function	Key	Symbol
Integer Multiply		*	Log°		Y TL
Integration		§	Loop Counter Divide		÷
Interchange		X	Loop Counter Multiply		*
Interval-centered Hanning		H1	Multiply°		Y *
Jump		J	Mass Store		MS
Keyboard		K	Output°		Y P
Label		L	Photoreader		R
List		/L	Plot°		Y K
List°		Y /L	Pointer		?
Load		X<	Polar Coordinates		TP
Log Magnitude		TL	Power Spectrum		SP

Variable Parameter or User Program

5451C OPERATING

Table B-1. Alphabetical Index (cont'd)

Function	Key	Symbol	Function	Key	Symbol
Print		W	Store		X>
Punch		P	SUB		
Put*		Y X>	Subtract*		Y A-
Qualifiers*		Y TR	Subroutine Return		<
Rectangular Coordinates		TR	Terminate		/
Replace		/R	Text*		Y W
Restart			Transfer Function		CH
Rotate		-	User Program (Gold Key)		Y
Skip		IF			
Skip*		Y IF			
Stop					

Variable Parameter or User Program